Pit and Quarry

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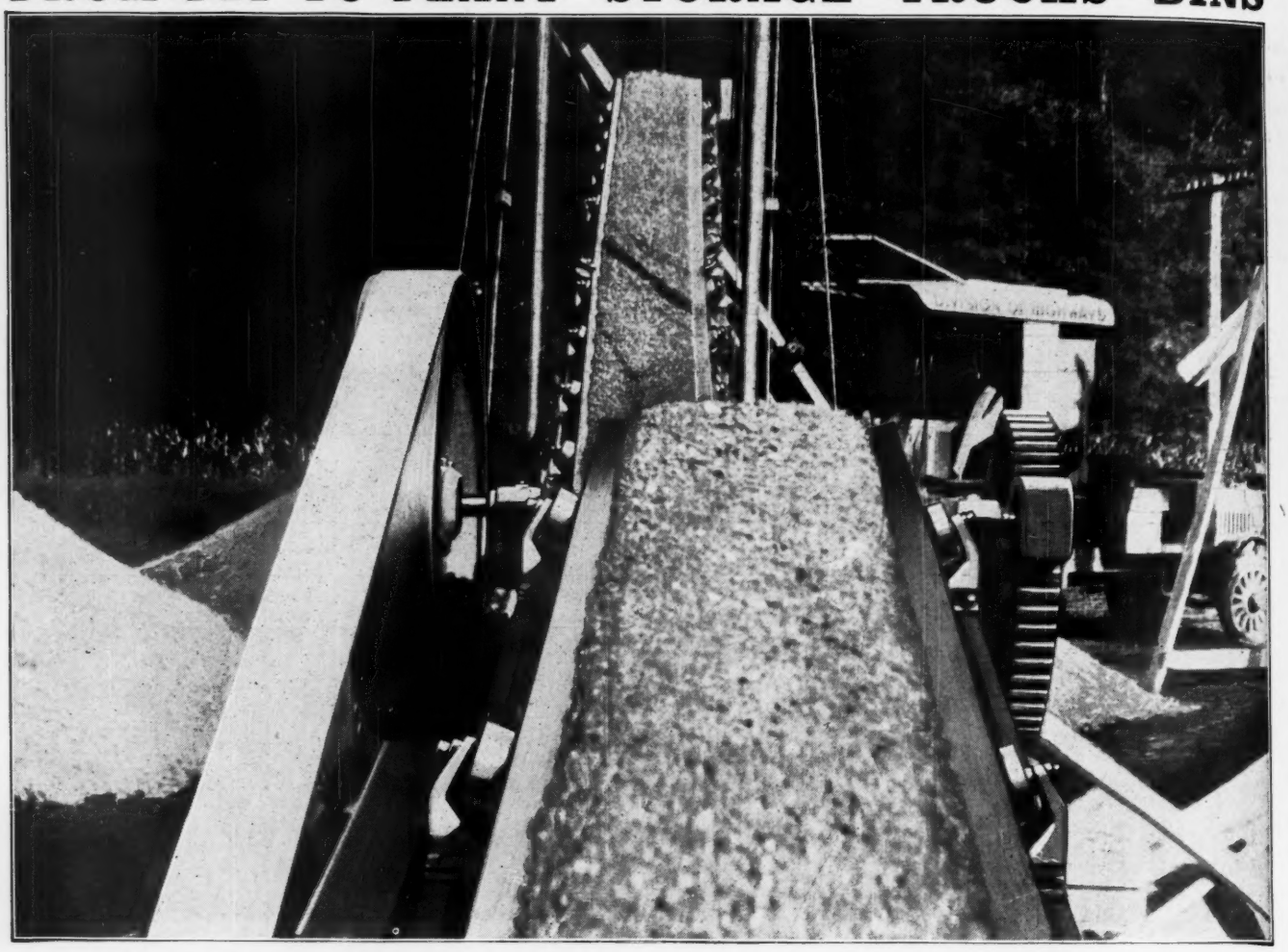

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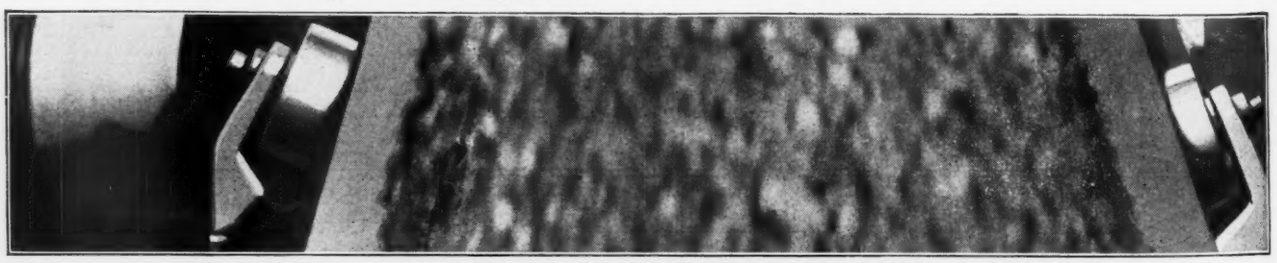

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Pit and Quarry

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THE UNUSUAL ASSOCIATION REPORT

ANNUAL reports of association executives are generally accepted as a necessary association procedure. We have seen many that were valuable documents. However, the present annual report of H. J. Love, secretary-treasurer of the National Slag Association, is something different. It is quite entertaining and we publish it in full here and suggest to all Pit and Quarry readers that they take time to go over it for the same reaction we received. Editor.

Ten years is a long time to be at anything—whether serving an indeterminate sentence for a Federal offense or attending to the multitude of duties that fall to the lot of a trades association executive.

In that time too, a tremendous lot of things can occur—But I notice that few of the old things pass out of the picture entirely. We usually manage to hang onto them and still find capacity for new friends, new arts, processes, ideas, and particularly new words. (More about them later).

Our particular group is so small, the contact of the Association so close; and the reports to members are so numerous and continuous, that I find myself placed in a most embarrassing position in turning out an "annual."

Once a year in most associations the "executive" gets an opportunity of telling how good he was, detailing the deeds accomplished, or explaining the causes that flopped those he didn't get over. There is much talk of the ethics of his particular crowd and the "barbarians" (non-members and "competition") given a thorough damning out. The deficit in the treasury is accounted for and a plan outlined to raise the money. And then comes adjournment.

You know what is going on at Association headquarters. You have the balance sheets at regular intervals. You learn of some of our heartaches here as well as possessing knowledge of our occasional hilarious moments.

Competition I find is composed pretty much of certain human beings likewise engaged in making a living and a large number of whom are thorough gentlemen. Non-members of the association are merely seeing the game on a friend's rain check or watching it through a knot hole in the fence.

But probably the worst detail of the situation is the fact that financially the association is not "in the red."

About all that is left for me is reminiscence, comment and prophecy.

Here are representatives of six companies of an original number which totaled ten in the National Slag Association.

Three buys, a bankruptcy, one company which took its blue dishes and went home because the Association wouldn't play according to the rules they wanted to lay down and this year we began with six of the original members.

The newest member deserves separate mention. Joining the association was merely L. P. Sibley's (Manager of the B. H. P. By-Products Pty. Ltd.) idea of fair play and the fact that probably ten thousand (10,000) miles of land and water separated his plant in Australia from the association office, the detail that the product of that plant had been sold up to the last ton of its possible production, the incident that he and his chief engineer were then (in October, 1927), visiting and collecting data in many countries using blast furnace slag as a construction material or as a raw material for other commodities, weighed as naught in his desire to become a member.

In his application for membership during his visit in this section, he stated that he liked very much our aims and our principles, that he admired our results and realized that they could not be accomplished without funds. Then he asked for something to be put up to his board of direction in writing, insisting that I present figures that represented the same proportionate support on a tonnage basis as you other contributors, and they accepted the proposition.

So now, truthfully speaking, "We are seven." "Likewise we still represent in annual tonnage of commercialized slag something less than five (5) per cent of the total estimated as produced by the mineral aggregates industry.

As the ten years that I have mentioned rolled by, there has been one outstanding fact observed, checked and, I believe, analyzed.

It can be summed up in the following—"Probably the cruelest thing in their lives that can happen to a man or a group of men is to so surround them with conditions that force him or them to actually think." To the average normal man such a situation alternates between "impossible" and "intolerable." The reaction in many cases is the keen-

est sort of resentment. Sub-conscious, perhaps, but often very tangible. Basically, we love to discover things ourselves. In like degree we hate to be told things.

If that is true, and I but quote in context from statements made by several psychologists who have written it as their belief, I'll let you "discover" the rest of the story yourself—so you won't hate me.

My suggestion is that you pity the specification writer. Pity him, but help him to the fullest possible extent. He is human like ourselves. Likewise he is actuated by a primitive motive called "self preservation."

Now face him with a new material and ask him to develop a specification for it and his first reaction is hesitation of commitment for fear he'll get himself into trouble or his reputation will suffer if he makes a mistake.

His second is to make comparisons with things that may be similar and about which he may believe he possesses or has access to some knowledge that is seemingly well founded and which rests on certain fairly well established facts.

Both situations are taken care of by words. Words of insistence and limitations. Some of them meaningless, many of them only confusing, all of them conceived on a basis of "Safety First" and "Protection"—And remember there's no doubt of his sincerity. But speaking of words—

In the following list is a part of the words taken from fifteen sets of fairly recent specifications on file in the Association office. The specifications were picked "Ene Meine Miney Mo" fashion from our entire collection and as a result represent requirements imposed by many men on "Mineral aggregates" to be used for the following purposes: Various types of highway construction, sewage disposal media, structural concrete and concrete products.

Sometimes in the specifications an individual word stood alone, occasional words headed a table, still others had a factor attached; together with instructions as to how it was to be determined. There were "Musts" and "Must nots" and a few "Mays" tied in with most of them and plenty of "Free Froms."

You know sometimes I wonder how the aggregates industry has ever carried such a load all the many years it has had material for sale. Here's the list—

Abrasion	Clean	Durable
Absorption	Cinders	Dust of Abrasion
Acid	Coal	Elongated
Age	Color	Flaky
Alkali	Compression	Flat
Angularity	Crushed	Friable
Basic	Deleterious	Glassy
Cementation	Density	Gradation
Chert	Dirt	Hard
Clay	Disintegrated	Honeycomb
Inert	Shale	Spongy
Iron	Schist	Strong
Laminated	Silica	Sulphur
Lime	Silt	Thin
Loam	Size	Tough
Mud	Slate	Uncoated
Organic Matter	Soft	Uniformity
Processing	Soundness	Washed
Sandstone	Specific Gravity	Weight

Along here a few years ago there were a number of isolated events that made the going a lot harder than ever for "Specifiers."

Slag came along and asked to be considered officially. The concrete boat came into existence on a fairly large scale and the Straub cinder block began to attract attention.

You all know more or less regarding the concrete boat program and the block I have mentioned. There may be as much or even more to be said about these others, but because of the type of narrative, I'm rather forced to stick to Slag.

Slag in particular just "wabbled a bit" all attempts to specify it along conventional lines. Particularly was this true in the concrete aggregate sizes. It had no thin, flat, elongated pieces; showed erratic behavior with generally high loss in the abrasion test; was not particularly tough nor hard and was deceptively sound in accepted tests for that quality; it did vary in unit weight and texture, possessed no detrimental action on reinforcing steel, seemingly aided all types of mortar binders and cementing agents in bonding with them; and did share in common with the best of the other commonly used aggregates, the qualities termed "Gradation" and "Cleanliness."

Whether it was used alone as a sewage disposal media, railway ballast, or in waterbound macadam, it gave an excellent account of itself. And when used as an ingredient in a "Finished Product", whether tested in a laboratory for qualities desired, or observed in service history, the mixture behaved in a satisfactory manner.

When it has failed in use either alone or as a part of a "Finished Product", then it has gone or is going in the same fashion that one might expect of other high grade aggregates under identical conditions of use, abuse, design, workmanship and temperature range—there is exactly the same amount of mineral aggregate left as when the contractor got his last estimate on that particular job.

The typical American spirit of good sportsmanship and love of fair play has never been more clearly exemplified than in the many laboratories which have conducted tests on mineral aggregates and "Finished Products" in which they were incorporated. Tiny in comparison as the total tonnage of Slag represents to that of the entire industry, it is becoming more and more of a rarity when it is omitted from really comprehensive test programs conducted by Federal, state, municipal and university laboratories or field investigations. One

industrial laboratory, that of the Portland Cement Association, has been particularly interested in Slag. The Bureau of Public Roads has, however, reported findings of more diversified investigations and tests than any one other group.

Off hand I would say from watching the progress of the groups that develop specifications for all mineral aggregates, they are beginning to incline towards the belief that "Granted a material is structurally sound (durable), that they can go but a few steps further in imposing limitations beyond 'Gradation' and 'Cleanliness'—with the possible exception of adding a weight requirement per unit volume of Slag when used for a few designated purposes."

However, in ten years too there has been a splendid advance in all fields in the understanding that should exist between the technical men and the producer, the buyer and the seller. Probably this condition that is approaching an open and above board stand, on a basis of mutual self respect and confidence, is more prominently exemplified in the division of the group that is represented by the test ing engineers. Contemplation of the fate of such men as Messrs. Crum, Abrams, Clemmer, Goldbeck, Walker, Anderton, Proudley, and others is interesting. But I will say this much, the movement towards harmony had started long before the men named were struck with commercial lightening.

A brief recital of four bits of conversation will bring out one detail a little clearer in reference to the last paragraph.

While talking with him approximately twelve years ago, a superintendent of my acquaintance said "To Hell with this highbrow stuff. We are turning out three sizes, tell the engineers that fact and let them take what we have or leave it, we're not manufacturing candy and putting it up in matinee packages."

About the same time one of the best, stubborn, and at the same time capable testing engineers in a prominent laboratory said "You'll never get anywhere with Slag if only for one reason. In the test for 'Loss by Abrasion' it makes such a rotten showing that, particularly in highway construction, you are absolutely going to be blocked."

Within the past year I've had lunch with the superintendent who during the meal was boasting of the ability of his men and equipment to turn out nine sizes of Slag so closely graded that they'd meet the strictest possible requirements of a wide variety of specifications and who talked most earnestly about "Fineness Modulus" and the study and experimenting he had done and was doing to prevent segregation.

Offsetting this was the comment of the testing engineer after a few days' trip eighteen months ago after he had inspected probably five hundred (500) miles of every possible type of highway construction in which Slag could be incorporated, and viewed dozens of highway structures and other examples of architectural composition in which Slag had been used. He said "I've seen such things in the east and the west; in the north and in the south. Yours are the full equal of anything that I've observed."

When I kidded him mildly by reminding him of his original statement he said " 'H. J.' I'm not silly enough to deny the evidence presented on this trip. I've changed my mind since them. It may be all right to register other materials by, but an abrasion test on Slag is not merely moist, but decidedly all wet."

Time was that I firmly believed that when a group of men got together and decided in a locked room what test limitations or requirements should be imposed on Slag, they were no longer scientists, but just technical Klu Klux Klansmen.

That condition has changed or is changing. Most technical groups are only too willing to listen to statements of proven facts and if they are meeting for the purpose of developing specifications for a material, a size of a commodity; even the color of a product, the chances are good that even if the producer is not represented at the meeting, his wishes in the matter are given considerable consideration, if in no other form than most careful perusal of his literature.

Just what has brought this about is the fact that the average producer of almost anything that you can name in the manufactured commodity line, is much better informed regarding his product at the present time than he was a few years ago, and on top of that he is telling the world what he knows about it.

Also it is more than barely possible that the practice of committees sponsored by Herbert Hoover, Secretary of Commerce, to develop specifications for materials, has had a decided influence. If such need is felt by a Hoover group, they first call in the producer and ask him to tell what he has, request him to present all of his data, classify all his grades and colors and shapes and sizes, and then after those details are whipped, present the results to the "buying" group. If there are any radical differences of opinions, then further meetings are called at which are represented both sides of the debated questions and when the final decision is reached, the best knowledge and experience available has been incorporated in the report, recommendation, standard, or "What have you?"

You, of course, recognize the difference between groups manufacturing or producing and shipping commodities that actually are distributed nationally and those whose production points were greatly isolated and shipping range restricted.

Yet whether one can reach them directly or not, potential opposition existed (and exists) continuously from certain men in the technical field. An engineer from a section of the country that pos-

sessed no steel industry and who might believe a blast furnace was a self-starter on a Ford car or a section of Hell with the lid off, might land a job within shipping range of a Slag crushing plant. Right then you had to start at the beginning and educate him.

As time went on and your accumulated data became more voluminous, that type of man became more and more easy to convince of the merits of Slag. The very fact that he was an engineer was the greatest advantage on your side. Sceptical and suspicious of what was to him a new construction material, his very background of technical education and training and experience, enabled him to grasp the meaning of curves, charts, columns of figures and general averages that he could check with a slide rule.

The Slag companies that either learned to speak his language or acquired talent within their respective organizations that could do it, were finding their "Sales resistance" cut down—in many places to the vanishing point.

In more subtle fashion there exists two other dangers that I consider about balanced in importance. Probably the first is the member of a committtee in a technical organization who will accept the honor associated with that contact, but who will not give of his time to attend meetings or to read the literature pertaining to the problems being considered. The second is the chap with a "Writer complex" who rushes his ideas into print without fully informing himself on the topics that he attempts to cover and thrusts aside the opportunity of availing himself of the tremendous stores of data, information, facts, that are in existence.

There is hope for the "Non-attending and Non-reading", but "Voting" member of a technical committee. If that group is a truly national proposition and he actually stops over for a committtee meeting or a national convention between trains, then there's a chance that he may meet a committee member whose familiarity with the material might bring some enlightenment to him. But only "The Great Specification Writer" can tell when someone will offer a manuscript to a publisher and face us with a lot of mistakes or erroneous personal opinions.

But there is another side to this story I'm telling. These specification writers and authors are not entirely to blame for the iniquities they create. Up until relatively recent times we've been in just as deep as they.

Something over three years ago the first steps were taken at the Association to bring about a correction of the faults that existed on our side of the situation. Finances have become available that will enable us to carry out a very reasonable program of presenting in printed form our story of the characteristics of Slag and the uses which have been developed for it in the economic fabric of the country.

The Symposiums are across. The direct register of sincere interest is in our files in letters expressing most cordial reception of this method of presenting our story. I may say the same thing in regard to the reports from one of the Contributors who possesses a mailing list that is as large as that of the Association's.

The reception of this material by the trades papers was most favorable too, but all was not sweet going as the following three details will indicate.

One man wrote on his return card "No Slag in my territory, therefore, not interested."

A second took the trouble to send back his card bearing the following:

"Better cut me out. Others here will get them who know more about the subject."

The third (and the last of this tiny group) wrote on the return card:

"This is O.K. but please, oh please, do not *mail* these symposiums to me as we get so damn many copies around here—why waste the postage? Nuff sed?"

In contrast, from a collection of probably a hundred letters written in appreciation of being placed on our mailing list, an internationally known man, famous for his research activities, rated as brilliant for his grasp of details in his field of endeavors, whose writings are used the world over as textbooks for an entire industry and the users of the product of that industry, wrote one which included the following paragraph:

"You are to be congratulated on the idea underlying this development and the excellent manner in which it is being carried out. I would say that this is a real stroke of genius and should have the effect of calling very widespread attention to the merits of slag as a concrete aggregate."

Yet each of these four men received with the first Symposium a clean-cut statement that they were getting it because they were members of various committees whose outline of work included consideration of Slag as a mineral aggregate for some specific purpose.

We are not swamped with requests in every mail for this data, but a day rarely passes that one does not reach us from some library, laboratory, university or individual. Germany and England has splendid representation. In book form, as it will ultimately appear, this material will have become more invaluable.

Some time ago I stopped thinking of Stone and Gravel as "Competition". True, I may still use the word—a habit of long years standing is hard to break—but in the final consideration are they not our "Big Brothers?"

Are we not all off the family tree of "Non-metallic Minerals?" Don't all of us depend largely on "Tax supported construction programs?" In "Siz-

ing" and many of the physical requirements and limitations, don't we have to face pretty much the same lists? Our plant problems are very similar, our troubles with transportation most certainly overlap and we share in common the tangles possible through misunderstandings, suspicions, prejudices and lack of definite and established facts. "Brother-in-law combinations" will still roll the best of us occasionally and just about ever so often recognition of "Political influence" has to be considered.

Here's another angle. A scramble within a certain territory where all three of the commonly used aggregates are available, develops to secure the order for a certain large job. The producers of only one aggregate can land it—But—No matter who gets it, the railroads serving that territory are the winners every time. In that respect we're all players in a big game with a "kitty" to be fed. If the game lasts long enough the rake-off gets all of the money. The situation parallels Mark Twain's comment about the weather.

After ten years of close observation, of weighing facts and figures where at all comparable, there has developed one most positive belief in my mind to the effect that if fairly judged on both laboratory behavior and on service history and values checked against the following list of words, there is little to differentiate one from another of the three commonly used mineral aggregates.

The list I have reference to is: Durability, Weight, Fire, Transverse, Yield, Compression, Workability, Bond, Uniformity, Impact—you may add as many more similar words if you care to and the statement still stands.

Prophecies—I promised them. Also I know what happens to prophets. Well, I'm risking that. Remember too that I'm putting no time limit on the realization of these details. Some of them, however, are on their way right now.

"Prescriptions Sizing" throughout the mineral aggregates industry as routine plant practice.

"Simplified Practice applied to Sizing all aggregates." And if a buyer wants freaks, then he pays for them at a price proportionate to the cost of producing them.

"Vari-colored Concrete Highways" being tried out now.

"More and more Slag being used in Portland and other cements."—arriving.

"Self Policing at Plants" and consequential definite knowledge of what was shipped and whether it did or did not meet the specifications covering the job to which it was being applied.

"Increase of number of jobs on which two or even more sizes of large aggregate are shipped." Self-explanatory.

"Swing to test of 'Finished Product' ". If it is concrete for a particular part of a job or even a single member of a structure, then state the quality requirements of the concrete.

"Development of a test or tests to apply to mixtures of bitumens and mineral aggregates." A most elusive problem, but a quite necessary development if the art of testing is to maintain its dignity.

"Tremendous increase in the interest directed towards maintenance of highways." I quote the man whom I believe leads in that field today—"Anybody can build a highway today by drafting men from the forces of the producers of materials; also the construction and test division of state highway departments and then leaning hard on specifications —but it takes a genius to keep them up to anything like approximately one hundred (100) percent of what they were when they were thrown open to traffic."

"You can anticipate almost unbelievable results from 'Investigation of Soil and Subgrade' when the facts are isolated and the underlying principles understood and applied, Slag will be strongly registered as 'Among those present' in the list of recommended materials used as correctives."

"Greater publicity regarding facts within the industry." Facts pertaining to capacity, stocks on hand, annual tonnages, etc.

"Look for the most intensive effort within and without the mineral aggregate industry field for sales research and determination of selling features to be gained by laboratory and field investigations."

At a point further back I mentioned "New additions to our vocabularies." Here are a few of them. All apply to the industry either directly or indirectly:

"Slag Consciousness"
"Fineness Modulus"
"The New Competition"
"Water-Cement Ratio"
"Hummer Screens"
"Agricultural Slag"
"Transverse Tests"
"Traffic Bound Highways"
"Bulking"
"Profitless Prosperity"
"Soil and Sub-Grade Research"
"Admixture"
"Retread Highways"
"Design of Mix"
"Association Research Laboratory"

In most part they are not new words at all. They are useful in describing new processes, new theories, new ideas—or accentuating an old one.

May I report that the investigation of the use of Slag in sewage treatment as a disposal media is progressing nicely and at the present time is probably a little more than half finished? The time for the report to the American Society of Civil Engineers cannot be set except approximately, but probably October will see it completed.

The work of the Problems Committee is taking form and the next few months should see a more tangible outline of Association procedure shaped up than we have ever possessed before.

As you know, there has been a delay of several

(*Continued on page 82*)

Asphalt Surfaces Discussed

Arthur H. Blanchard, consulting highway engineer and professor at the University of Michigan, at the 6th annual Asphalt Paving Conference, held at Atlanta, Georgia, presented a paper on the "Relative Advantages of Smooth and Rough Texture Asphalt Surfaces." In this paper he first discusses the early developments in the use of asphalt as a surfacing material for highways and sums it up by saying that two of the characteristics then held important in the design of asphalt surfaces are still so considered, namely, imperviousness and nonslipperiness.

In considering the subject of this paper from the viewpoint of the practice and problems of today, it appears advisable to have a picture of what constitutes a smooth asphalt surface and what is meant by a rough texture asphalt surface. As both rough and smooth are relative terms, said Mr. Blanchard, it is difficult to define either of these types of surfaces without causing some disagreement as to their classification. However, he believes, there is general agreement in stating that European rock asphalt pavement surface is smooth, and that the surface of an asphaltic macadam pavement finished with a seal coat of asphaltic cement and ¾ inch stone has a rough texture. Between these two types of surfaces many variations are found, especially those characteristic of asphaltic concretes and asphaltic macadams. These variations are believed to be due to a major consideration by the designing engineer of one or more of the following factors: imperviousness, density of the upper layer of the wearing course, non-slipperiness, durability, first coat, maintenance cost, availability of materials or equipment, and suitability for the traffic and local conditions. The last group mentioned includes tractive resistance and tire wear.

The kind of asphaltic pavement selected for a given locality is not always dependent on the type of surface, and while there may not be much difference in the texture of sheet-asphalt pavement surfaces it is possible to complete most kinds with any type of surface desired. Types of surfaces are classified under two general groups: those having a surface subjected to traffic composed of the surface of the wearing course; and those having a surface subjected to traffic formed by the application of a seal coat to the wearing course. The second group may also be divided into two classes: surfaces constructed with seal coats of asphaltic cement followed by the application of a covering of sand, crushed stone, slag, or other fine material; and surfaces constructed with seal coats of precoated fine aggregate, with or without the application of other fine material.

Two or more types for a given location and set of conditions may be compared from the standpoint of any of the above factors. Due to the many variables entering into the problem, however, Mr. Blanchard considered it advisable to limit his paper to the discussion of one important factor, that of slipperiness.

The slipperiness of pavement surfaces is now before the public to a greater degree than ever before because of the millions of vehicular operators, the general interest in the causes of highway accidents, the publicity given to accidents resulting in material property damages, injuries and fatalities, and the many campaigns under way to promote highway safety. In "Accident Facts—1927," published by the National Safety Council, it is recorded that out of 112,790 accidents reported in 1926, 5,727, about 5 per cent, were due to skidding.

More detailed information is available from the reports of the Motor Vehicle Bureau of the State of New York. Here the character of information required is indicated by the following:

Character of road: curve, up-grade, down-grade, street intersection, railroad crossing, bridge, culvert, straight.

Road Surface: wet, dry, mud, snow, ice, sand.

Weather conditions: fog, mist, rain, snow, clear.

In 1925, this Bureau reported 58,444 motor vehicle accidents, of which 2,752 were attributed to skidding. Condition of the road surface was reported in 45,892 cases as follows: dry, 34,752; wet, 9,051; muddy, 124; snowy, 873; icy, 1,092. Weather conditions were reported in 45,873 cases as follows: clear, 36,501; cloudy, 2,171; fog, 419; rain, 6,046; snow, 736. It is thus seen that it is practicable to assume that the vast majority of skidding accidents occurred under the conditions of roadway surface usually considered as being contributory causes of skidding. This conclusion is further substantiated by the fact that in January, 1926, a winter month, of 2,547 accidents reported, 768, or about 30 per cent, were due to skidding. Further evidence is furnished by the results of investigations at Iowa State College. These show that on roads coated with snow or ice, oily slime, or mud, the force required to cause skidding is approximately one-fourth of that on clean, dry surfaces; while on icy roads that are thawing a little it may be as low as one-sixth.

Investigations indicate that a large percentage of skidding accidents are due to improper operation, due in part to carelessness but also in large measure to a lack of appreciation on the part of the motorist of the distance required in which to stop a motor vehicle under the varying conditions of roadway surfaces.

Mr. Blanchard believes that research and study by specialists of the relative advantages of smooth and rough texture asphalt surfaces, in conjunction with a campaign by the various highway, automobile, and safety organizations to inform motorists as to the conditions under which skidding is liable to occur, would result in a material reduction of such accidents.

MEN OF THE INDUSTRY

The portraits printed on this page in each number of PIT and QUARRY are taken from our files and their selection is without significance as to current events or as to the position of the individual in the industry.

Earl Zimmerman

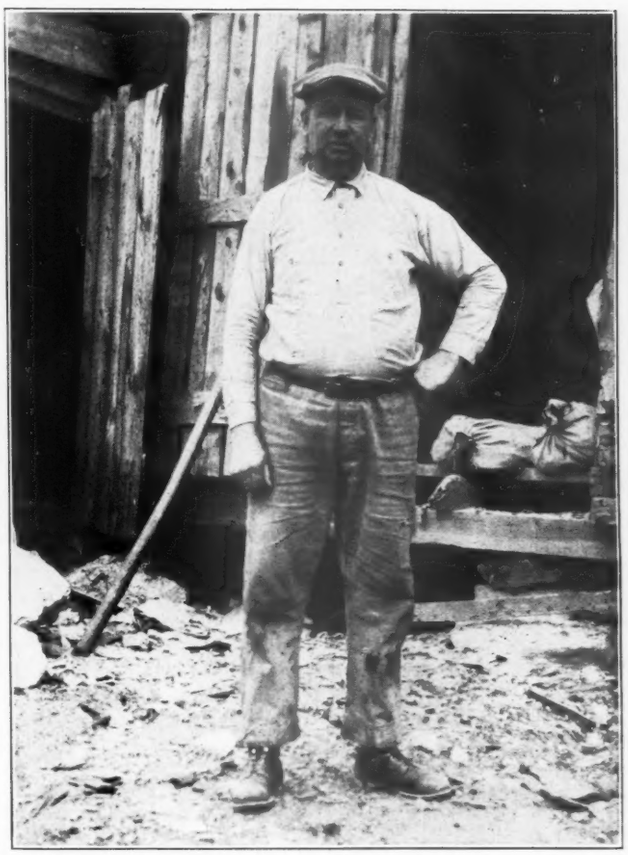
Mr. Zimmerman is President of
the Ohio Gravel Ballast Company
of Cincinnati, Ohio

MICA MINING IN NEW HAMPSHIRE

By F. A. Westbrook

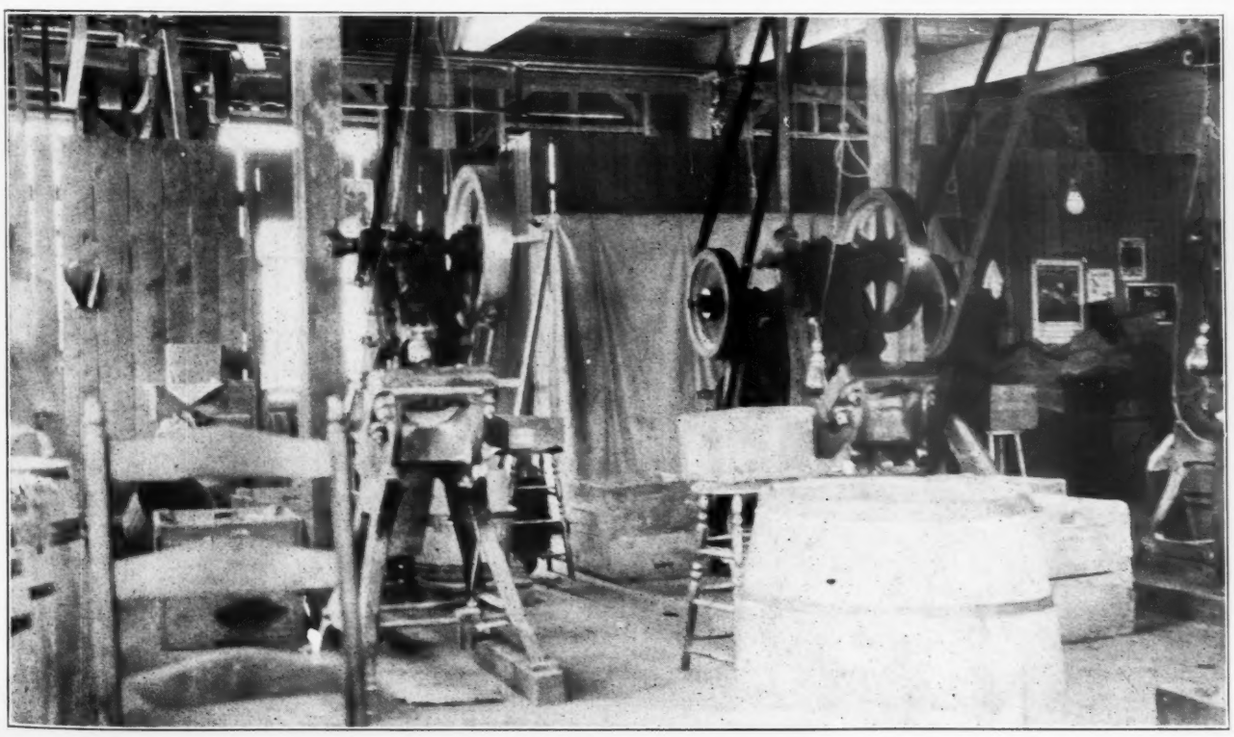
MICA has been mined in the Alstead region, near Keene, N. H., for a hundred years or more and naturally is a well established industry. An interesting legend concerning the working of the New Hampshire Mica and Milling Company has it that this particular mine, or quarry, was started where mica showed in the diggings at the entrance to a woodchuck's hole. Whether this can actually be substantiated or not need not be gone into here but whatever the reason for the beginning may have been there is now a good sized opening which goes to a considerable depth. "Books" of mica are plainly in sight along the wall in various places. There is a large amount of feldspar present but no particular effort is made to use it, except occasionally. This is in contrast to the practice of the Golding Keene Company, which has a large operation nearby and makes as much of the feldspar as the mica, if not more.

The drilling is done in benches with Ingersoll-Rand jack hammers. The holes are made about 2 feet apart, 3 feet back and 6 feet deep. Forty per cent Atlas dynamite is the explosive and sometimes as many as thirty holes are shot at a time. The reason why the holes are so close together and not deeper is because it is desirable to break up the rock in small pieces so that the mica may be procured with the least possible amount of labor. This must finally be done by hand as a crusher would ruin the sheets of mica.



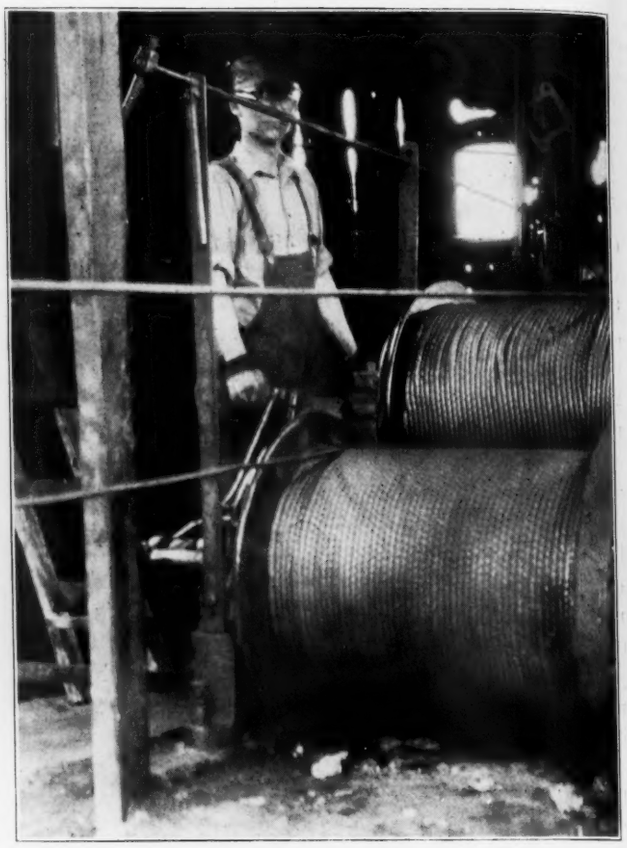
Mr. Mosher, Superintendent of the Quarry

When it is necessary to start a new bench on the floor of the quarry Mr. Mosher, the quarry superintendent, makes what he calls a "hog's trough." This merely consists of drilling in at an



Punches Where Various Forms of Mica Are Made

Quarry Dump and Cableway



B. Fiske Bryan, Hoisting Engineer, on Duty

angle toward a common centre line from the two sides of the trough and blowing out a part of trench. The bench may then be worked from both sides. Air for the drills is supplied by a gasoline engine driven compressor unit made by Ingersoll Rand. This is located in a small building of its own on top of the quarry.

Material is hoisted out by means of cableways. The carriages which travel on these were made by the Williams Machine Company of Poultney, Vt. and the wire rope was purchased from the Roebling Company. The hoisting engine is a Lidgerwood steam driven unit furnished with steam from a heavy seamed New York boiler. In one end of the hoister house is a forge equipped with a Buffalo blower.

View of Interior of Mill at Keene

One of the Work Benches and Punches in Mill

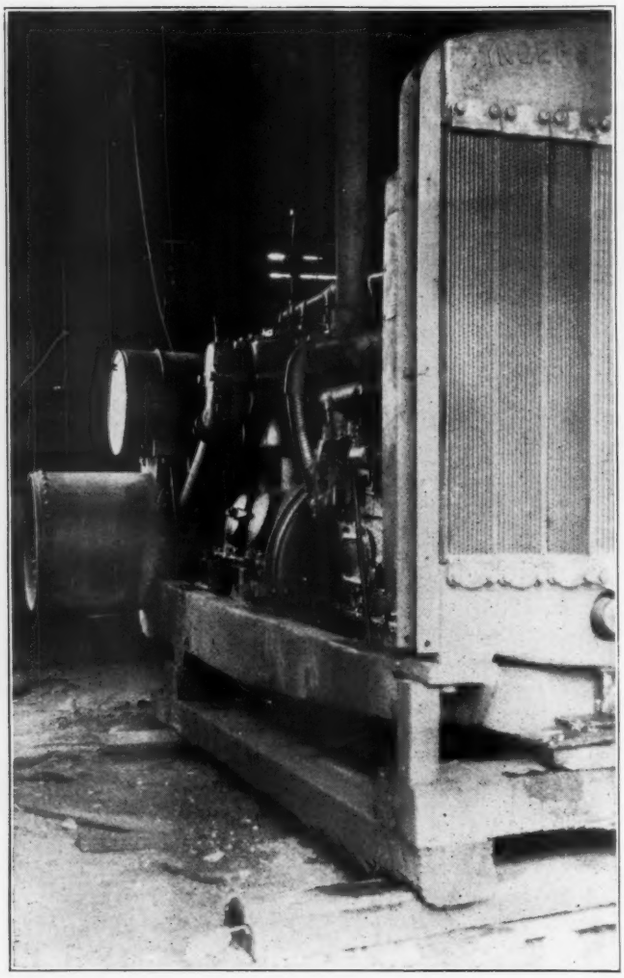
The quarry is worked all winter. This is necessary to keep the mill, located in Keene, busy. Snow does not interfere very seriously as the space where work is being actively carried on is never very great at any given time. In fact a dozen skip loads of snow after each snow-storm are sufficient to clear off the small working area.

After the mica has been brought to the surface it is taken down to the mill at Keene, a distance of eleven miles, in Reo Speedwagons. These are well adapted to the rapid transportation of this kind of material which is not comparable as to weight or bulk with feldspar, crushed stone or similar materials.

As soon as the mica arrives at the mill it is brought in and weighed on the ground floor. It is then taken upstairs on a freight elevator and carried to the sorting room where the "rifters" or "sheeters" pick out the pieces suitable for punchings and drop the remainder into a bin. This feeds the crusher downstairs. The crushed mica is then carried upstairs by an elevator and delivered to the pulverizers.

In the sorting room the mica is graded according to its quality. The three qualities are No. 1 stone which is clear, No. 2 stone which may be slightly stained but still clearly transparent and electrical mica which need not be clear at all but

The Mill at Keene, New Hampshire



Gasoline Driven Air Compressor at Quarry

must have clean cut laminations. Each class is next sorted according to size. Of course the larger the sheet the more valuable it is. The great bulk of course is "punch" or "washer" mica suitable for small punchings. Splitting into proper thickness is also done in this department. In addition to the mica obtained from the Company's own mine considerable amounts are purchased from India.

When the various grades and sizes have been separated they are taken to the punching room where there are a number of punches, made by the E. W. Bliss Company and the Hill Clark Company, in which the various shapes are punched out. The scrap from these operations also goes to the crushing department together with materials not good enough for classification. Most of the work in the mill is done by girls as it is light in character and electrical power is used.

Grade Crossing Accidents

Since 1920 a total of 16,793 persons have been killed in grade crossing accidents, the American Road Builders' Association reports. The year 1927 was marked by a noteworthy decrease for the first time since 1900.

During 1927, a total of 2,371 persons were killed and 6,613 were injured in these accidents. Louisiana reported the highest death rate with 3.02 fatalities for each 10,000 registered automobiles. Mississippi was second with 2.02 deaths per 10,000 cars. The lowest fatality rate was found in Wyoming where no persons were killed and only one injured at grade crossings during the year. Rhode Island had the low death rate of .08 persons per 10,000 automobiles.

At the beginning of the year the American Road Builders' Association asserts there were 206,533 unprotected grade crossings, an increase of 1,457 over the previous year. Texas had the largest number of unprotected crossings with a total of 11,771. Rhode Island had the smallest number of unprotected crossings, that state reporting but 58. Delaware was second with but 251. Wyoming, the only state which reported no fatalities, had 588 unprotected crossings.

The casualties occurred during 1927 at grade crossings are reported by the American Road Builders' Association from a tabulation made from work sheets and reports obtained by the Interstate Commerce Commission. The record follows:

State	Total Deaths	Total Injuries	Unprotected Crossings
Alabama	34	143	4,125
Arizona	9	28	958
Arkansas	23	91	4,251
California	118	330	6,254
Colorado	24	48	2,766
Connecticut	10	23	461
Delaware	7	29	251
Florida	34	125	4,682
Georgia	36	137	5,080
Idaho	9	16	1,838
Illinois	205	567	2,376
Indiana	188	431	7,977
Iowa	35	148	1,035
Kansas	55	241	1,386
Kentucky	48	119	2,883
Louisiana	41	84	3,161
Maine	11	13	905
Maryland	20	38	815
Massachusetts	22	55	708
Michigan	118	388	8,261
Minnesota	35	101	8,117
Mississippi	52	123	2,783
Missouri	44	142	7,242
Montana	4	33	2,268
Nebraska	23	56	6,657
Nevada	2	5	432
New Hampshire	12	21	702
New Jersey	89	206	1,667
New Mexico	9	19	940
New York	193	452	5,024
North Carolina	33	113	4,687
North Dakota	10	32	5,629
Ohio	300	619	9,673
Oklahoma	41	141	7,285
Oregon	16	29	1,723
Pennsylvania	139	434	8,425
Rhode Island	1	6	58
South Carolina	11	69	3,544
South Dakota	13	23	4,626
Tennessee	43	122	3,958
Texas	86	350	11,771
Utah	4	24	1,491
Vermont	10	33	468
Virginia	49	71	3,518
Washington	20	73	3,596
West Virginia	22	55	2,196
Wisconsin	63	206	7,075
Wyoming	None	1	588
District of Columbia	....	....	22
Totals	2,371	6,613	206,533

KEEPING DOWN THE COST OF DELIVERY

By J. J. Berliner

MOTOR truck delivery cost is a subject of vital importance. Numerous executives have realized that truck operating costs were much too high and have been grappling with the problem of how to reduce them.

The first and most important step to take in order to eliminate waste in delivery is to keep systematic records of truck costs. A simple system of accounts consisting only of two or three forms and requiring only a few minutes per day per truck to keep going, will furnish an accurate analysis of all the operating truck expenses. These records of truck costs will reveal dozens of essential facts about the trucks: Whether the trucks are being operated efficiently or not, and why; what leaks are reducing the profits, and where; what means should be employed to speed up the delivery system and how they should be put into effect.

Importance of Systematic Analysis

Here are some of the facts which an executive wants to know—and should know—about his trucks; facts which a few simple cost records will tell him.

How much does it cost to deliver per ton?

Which make of tire gives the most mileage?

Which driver is the most efficient?

Which truck shows the least cost for repairs?

Which route is the most profitable?

Which route shows the most standing time?

Which truck uses the most fuel in proportion to mileage?

Which truck covers most mileage in a day, month or year?

What spare parts were ordered and at what cost?

What is the cost of truck operation for a day?

What is the cost of truck operation for a month?

What is the cost of truck operation per mile?

What is garage costing?

How does fuel used check up with mileage run?

What is the comparative record of two trucks with reference to:

Trips per day?

Stops per day?

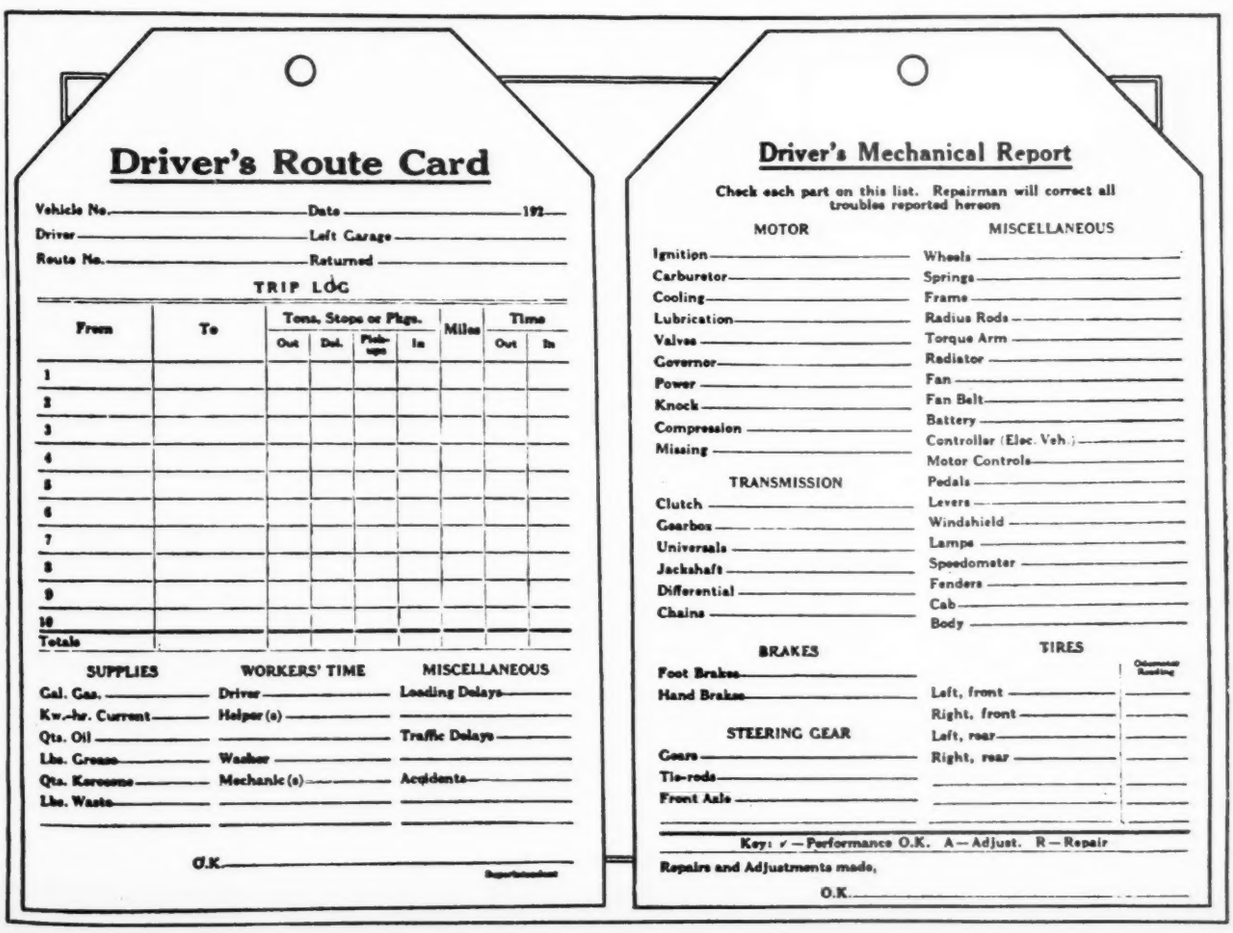
Miles per day?

Days in service?

Days out of service?

Repair cost per mile?

All of these questions are pertinent to the costs and performances of your motor truck. They show up the weak spots in your truck system. By comparison, they show what is good and what is



Driver's Route Card

Vehicle No. _____ Date _____ 192—

Driver _____ Left Garage _____

Route No. _____ Returned _____

TRIP LOG

From	To	Tons, Stops or Pkgs. Out	Del.	Pick-ups	In	Miles	Time Out	In
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
Totals								

SUPPLIES	WORKERS' TIME	MISCELLANEOUS
Gal. Gas. _____	Driver _____	Loading Delays _____
Kw.-hr. Current _____	Helper (s) _____	_____
Qts. Oil _____	_____	Traffic Delays _____
Lbs. Grease _____	Washer _____	_____
Qts. Kerosene _____	Mechanic (s) _____	Accidents _____
Lbs. Waste _____	_____	_____
_____	_____	_____

O.K. _____

Superintendent

Driver's Mechanical Report

Check each part on this list. Repairman will correct all troubles reported hereon

MOTOR	MISCELLANEOUS
Ignition _____	Wheels _____
Carburetor _____	Springs _____
Cooling _____	Frame _____
Lubrication _____	Radius Rods _____
Valves _____	Torque Arm _____
Governor _____	Radiator _____
Power _____	Fan _____
Knock _____	Fan Belt _____
Compression _____	Battery _____
Missing _____	Controller (Elec. Veh.) _____
	Motor Controls _____
TRANSMISSION	Pedals _____
Clutch _____	Levers _____
Gearbox _____	Windshield _____
Universals _____	Lamps _____
Jackshaft _____	Speedometer _____
Differential _____	Fenders _____
Chains _____	Cab _____
	Body _____

BRAKES	TIRES	Odometer Reading
Foot Brakes _____		
Hand Brakes _____	Left, front _____	_____
	Right, front _____	_____
STEERING GEAR	Left, rear _____	_____
Gears _____	Right, rear _____	_____
Tie-rods _____	_____	_____
Front Axle _____	_____	_____
_____	_____	_____

Key: ✓—Performance O.K. A—Adjust. R—Repair

Repairs and Adjustments made,

O.K. _____

faulty in your system of delivery truck operation.

The analysis of truck cost may be divided into two parts:

1. Variable expense.
2. Fixed expense.

Variable expense consists of a series of items that enter into the cost of operation and maintenance, which are not fixed or ascertainable beforehand. Such items are gasoline, oil, tire cost, repairs, etc.

Fixed charges are those expenses which are fixed and known in advance. Such items comprise, taxes, licenses, insurance, wages, depreciation (if not figured on a percentage basis), etc.

By keeping a "Daily Truck Record Card," a complete record of the truck's performance for the day is furnished showing such essential information as: number of miles covered, number of tons carried, gasoline, oil and grease consumed, driver's working time, time lost by driver, time taken for lunch, etc.

However, each individual can decide for himself as to the addition or omission of various items in this record card, according to the information he deems most desirable.

A monthly summary and recapitulation, at the end of the month (or every 3 or 6 months, if desired), may be made from the driver's daily record cards, giving the total gasoline, oil, grease, etc. And also the drivers' wages.

The tire expense for the month or period is then ascertained or estimated, and the fixed and known items, such as taxes, depreciation, etc., are then put down.

A monthly summary and recapitulation is strongly recommended. From the monthly summary and recapitulation sheet we are in a position to obtain information that is absolutely necessary for a progressive concern.

(1) Cost of gasoline per mile
  Total gasoline used
  Total mileage

(2) Total cost per mile
  Total cost
  Number of miles run

(3) Cost per ton to deliver
  Total cost
  Total tons carried

(4) Cost per day operating
  Total cost
  Days operating

(5) Cost per ton per mile
  Total cost
  Total ton miles

(6) Cost per order per mile
  Total cost
  Total package miles

All of this information is obtained by reference to the summary sheet, and is exceedingly important.

From the cost per day operating, the executives can tell which trucks are most economical. By taking the daily record cards of each truck and comparing with the cost per day of operating on the monthly summary sheet, it is easy to find out which truck uses more gasoline per mile, and also serves as a check on the driver's efficiency.

The cost of gasoline per mile also enables the executive to compare the different trucks, as to which truck uses more gasoline per mile, and also serves as a check on the driver's efficiency.

Ways of Cutting Delivery Cost

The basis of every good delivery system is proper zoning. However, which zones are best, can only be ascertained by constantly experimenting. For this purpose, maps should be kept, as large as possible, showing streets, roads, bridges, and ferries, and marked off so as to show each one at a glance. By constantly experimenting and making changes, better scheduling and routing will be obtained. For example, one concern whose trucks had to cross a ferry every day found that each driver lost almost two hours each day, because of waiting at the ferry slip. By changing the scheduling, the trucks crossed the ferry when traffic was at low ebb instead of when traffic was at its highest peak, and was thus able to save two hours daily for each truck.

Time is often lost by sending trucks through congested streets or over bridges, when traffic is very heavy. By slightly revising our schedule, much time can be saved through avoiding congested streets, bridges and ferries when traffic is heaviest.

Use of Trailers Cuts Cost of Delivery

In many sections of the country, where roads are fairly level and hauls are rather long, concerns have tried the use of trailers and have found that the use of trailers in many instances cut their costs almost 50 per cent.

Compared with the truck, the initial cost of the trailer is only a quarter; taxes are one-half; maintenance is almost one-eighth; tires are much less because of the absence of power plant and gear; drivers' wages are eliminated, and insurance is much lower. Furthermore, it is found that the gasoline required to haul the truck and trailer is only slightly increased. Of course, the speed is materially decreased, but that is more than made up by the increased capacity and lower cost of haulage. In addition, trailers save a lot of time in loading and unloading.

However, trailers should be designed and constructed with much care and skill and the proper type selected, taking into consideration the conditions of the roads traversed.

Trailers fall into four general classifications:

1. Four-wheel trailers.
2. Two-Wheel trailers.

3. Semi-trailers.
4. Pole or pipe trailers.

The four-wheel trailers are subdivided into reversible and non-reversible types; light high-speed trailers; heavy duty trailers, hauled by motor trucks for general haulage purposes; straight frame and drop frame models; and slow speed trailers with dump bodies for use in trains with tractors.

Two-wheel trailers may be classified into light and heavy types, for use respectively with passenger cars and motor trucks, dumping and non-dumping types.

The semi-trailers may be classified as to straight frame and drop frame types. Pole and pipe trailers are made in extension and non-extension reach types.

Almost any type of body can be mounted on the four-wheel trailer and the two-wheel trailer. The pole and pipe trailers are not intended to carry bodies, but instead are provided with bolsters to retain their load.

Trailers vary in size and type, ranging from ½-ton capacity to 15-ton capacity. Many concerns can increase their profits substantially by adapting trailers suitable for their type of delivery.

Drivers' Cooperation and Proper Maintenance

No matter how good a machine is, much depends upon the driver. The driver is entrusted with the truck, which usually represents an investment of a thousand dollars and upward. How long a truck will last depends a great deal on the care with which the driver runs his truck.

A careless driver can, in a few minutes, cut the life of a truck by a few years, or can run up excessive repair bills by neglect. Thus, for example, many drivers often permit their lubricating oil to run down and keep on driving without sufficient lubricating oil. Sooner or later, this leads to big repair bills. It is possible to burn out a truck in ten minutes by running it without lubricating oil.

2 A

TRUCK COST SYSTEM

Month ending .....192.....

Make of Truck .....

Operating Charges

Gasoline .....gal. @			
Oil .....qts. @			
Grease .....lbs. @			
Kerosene .....gals. @			
Waste .....lbs. @			
Driver .....days @			
Helper .....days @			
Mechanic .....hrs. @			
Misc. .....@			
A. Total Operating Charges			

Maintenance Charges

Tires .....miles @			
Repairs	Estimated		
Overhauling			
Painting, etc.			
Garage rental (pro rata)	year		
B. Total Maintenance Charges			

Fixed Charges

Insurance, fire	.....per year		
Liability	.....per year		
Collision	.....per year		
Interest 6% (item 1 ÷ 2)			
Depreciation on chassis	per mile		
" " body	per mile		
" " equipment	per mile		
Total Taxes and Licenses			
.....	per year		
C. Total Fixed Charges			

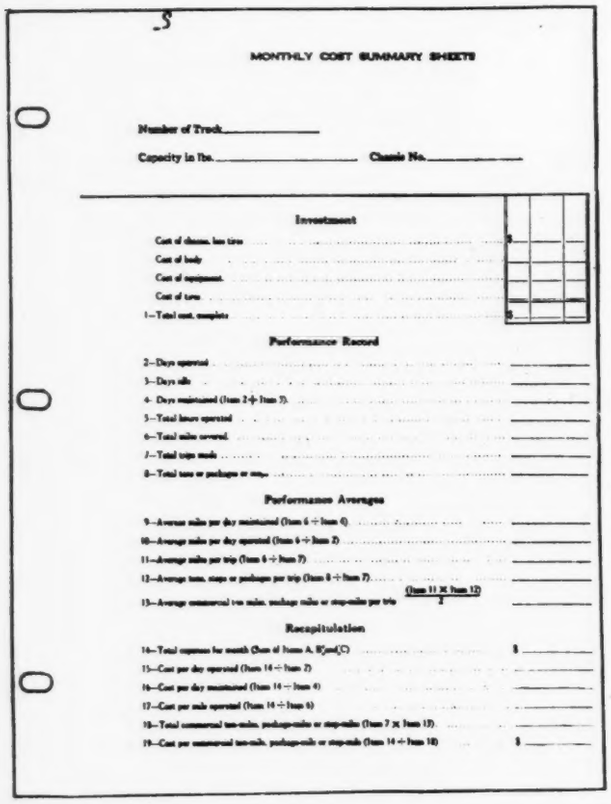
Another vital factor in prolonging the life of the truck is that of proper maintenance. To keep the truck in proper condition and retard depreciation, the truck should be periodically inspected, and any defects discovered should at once be repaired. About once after every 10,000 miles of running, the truck should be completely overhauled.

However, it is the cooperation of the driver himself, that it absolutely necessary. In the long run, the driver is the deciding factor on how long the truck will last. In the matter of tires alone, a great deal of money can be saved by educating drivers to be careful and by proper inspec-

FRONT OR REAR — **TIRE RECORD** — FRONT OR REAR

SIZE _____ TRUCK MAKE _____ TRUCK CAPACITY _____ WHEEL NO. _____

MAKE	TIRE NO	TRUCK NO.	PUT ON	TAKEN OFF	Mileage	Cost	Order NO	ADJUSTMENTS Tire No	Put on	Wheel No	Take Off	Mileage	Cost	TOTAL Mileage	Cost	Cost Mile	REMARKS



MONTHLY COST SUMMARY SHEETS

Number of Truck._____

Capacity in lbs._____ Chassis No._____

Investment

Cost of chassis, less tires
Cost of body
Cost of equipment
Cost of tires
1—Total cost, complete

Performance Record

2—Days operated
3—Days idle
4—Days maintained (Item 2 + Item 3)
5—Total hours operated
6—Total miles covered
7—Total trips made
8—Total tons or packages or stops

Performance Averages

9—Average miles per day maintained (Item 6 ÷ Item 4)
10—Average miles per day operated (Item 6 ÷ Item 2)
11—Average miles per trip (Item 6 ÷ Item 7)
12—Average tons, stops or packages per trip (Item 8 ÷ Item 7)
13—Average commercial ton-miles, package miles or stop-miles per trip $\frac{\text{(Item 11} \times \text{Item 12)}}{2}$

Recapitulation

14—Total expenses for month (Sum of Items A, B, and C)
15—Cost per day operated (Item 14 ÷ Item 2)
16—Cost per day maintained (Item 14 ÷ Item 4)
17—Cost per mile operated (Item 14 ÷ Item 6)
18—Total commercial ton-miles, package-miles or stop-miles (Item 7 × Item 13)
19—Cost per commercial ton-mile, package-mile or stop-mile (Item 14 ÷ Item 18)

tion and remedies. The photographs on the preceding page show some of the abuses which cut the life of the tire and which can be remedied by the drivers' cooperation.

Effect of Tires on Cost

The majority of delivery trucks are using solid tires and in a few cases pneumatics are used where the truck is a light one, of 1 or 1½ tons capacity. In some cases, cushioned solid tires are used because they absorb vibration more than the solid tires. Comparing the three types of tires, we have the following advantages and disadvantages of each:

Pneumatic Tires

Advantages

(1) More speed than solid or cushioned.

(2) Reduces vibration to a minimum, absorbing road shocks.

(3) Lightness of pneumatics dispenses with heavy rims and steel bases required with solid and cushioned tires.

(4) Ease with which pneumatic tires are changed.

Disadvantages

(1) Liability to puncture or blow out.

(2) Cannot be used with heavier trucks (trucks over 1½ tons).

Solid Tires

Advantages

(1) Lasts Longest.

(2) Cheaper.

(3) Carry heavier loads.

(4) Can't puncture or blow out.

Disadvantages

(1) Does not absorb vibration and road shocks

(2) Changing of tires causes machine to be laid up, as taking off and putting on solid tires requires special equipment.

Cushioned Tires

Have same advantages and disadvantages as solid tires with these exceptions:

(1) Cushioned tire is more resilient and absorbs vibrations and road shocks much better.

(2) Many claim that cushioned tires do not stand up and last as long as the solid tires.

Importance of Keeping Record of Tires.—In order to determine which tire is giving the best service and stands up best, it is well to keep a record of all tires. The following is a form of special construction. It is a simple record, one of these card forms being used for each truck. On it, is the following important information: Name of the make; tire number; truck number; when put on; the cost, etc. Where a tire is purchased and fails to live up to the manufacturer's guarantee, it is easy to prove from tire record card that the tire has fallen short of its guaranteed mileage. Other advantages of the tire record card are that it enables the executive to know when adjustments must be made and finally he can tell just how much his tires cost per mile.

Many rules have been given recently to aid in the saving of rubber, especially automobile tires. A new list has just been compiled by A. H. Hoffman, agricultural engineering division of the University of California, and they are given below:

Don't give tires unnecessary sunlight; they enjoy the dark.

Don't make emergency stops a habit; every slide takes a layer of rubber.

Don't see how quickly you can start; spinning wheels are out of fashion.

Don't "step on it" just because it's raining; speed plus sharp stones multiplied by water equals bill for new tires.

Don't round that curve on two wheels; even if your neck isn't valuable, rubber is.

Don't run with wheels out of line; the price of new casings is up.

Don't rim-cut that "down" tire by running it to a "free air" station; someone might suspect you were too lazy to use the hand pump.

Don't run over all the ash piles, broken bottles, naily boards, and other rubbish you can find; even a harmless appearing paper bag may have a brick in it.

Don't park in that puddle of oil; oil eats rubber.

Don't use the curb as a brake; it may break a casing.

Don't stop on an old bonfire; it may still have some "kick" in it.

Don't destroy that old casing; for some uses the rubber in it is just as good as new.

USES AND PROPERTIES OF GYPSUM

By Prof. Peter P. Budnikoff*

GYPSUM is a very interesting product, from a physical technical as well as a practical standpoint.

When gypsum, $CaSO_4 . 2H_2O$, is heated to a temperature between 107 degrees and 170 degrees Cent., all except a half molecule of water is lost and it becomes a dull white in color. Such gypsum is known as plaster of Paris and is composed chiefly of the semi-hydrate $CaSO_4 . \frac{1}{2}H_2O$. When plaster of Paris is brought in contact with water, absorption takes place during a certain interval of time (up to half an hour) with generation of heat and an increase in volume up to one per cent.

When gypsum is subjected to a temperature between 170 and 200 degrees Cent. it will still retain water, but will consist chiefly of the so-called soluble anhydrite $CaSO_4$, which sets rapidly when mixed with water. When heated to temperatures between 200 and 250 degrees Cent. it still retains traces of water, but the time of setting is lengthened. At still higher temperatures, from 400 to 750 degrees Cent. the gypsum will be free from water; in this case it consists chiefly of the so-called insoluble anyhdrite, the setting of which is so slight and takes place so slowly that for practical purposes it may be considered as non-setting and is designated as "dead burnt." When ignited at a temperature over 750 degrees Cent. it gets the property of combining slowly with a small amount of water, setting slowly to form a compact mass which is hard and very resistant to the action of the weather. Such a product is designated as hydraulic or Estrich plaster.

Accordingly there are several forms of gypsum: a stable dihydrate occurring in nature,, $CaSO_4 . 2H_2O$; a semi-hydrate, $CaSO_4 . \frac{1}{2} H_2O$; and finally the water-free anhydrite $CaSO_4$ occurring in at least two forms: a soluble (artificial), and an insoluble (natural or artificially produced) one.

The common conditions of existence of the hydrates of gypsum differ from the ordinary systems. Complications arise from the fact that there are no exact transition points between the different hydrates, on account of which the corresponding curves can not be ascertained with exactness. The phase rule alone gives but few indications in the study of the system $CaSO_4 + H_2O$. Within a range of temperature of from 0 to 110 degrees Cent., all four phases: $CaSO_4 . 2H_2O$, $CaSO_4 . \frac{1}{2}H_2O$, $CaSO_4$, soluble and insoluble can co-exist. There is no steady range of existence for a hydrate. On the other hand $CaSO_4 . \frac{1}{2}H_2O$ occupies a special position inasmuch as the transition from gypsum $CaSO_4 . 2H_2O$ to soluble or insoluble anhydrite $CaSO_4$ lies below the transition point to semi-hydrate.

According to Van't Hoff transition occurs:
$CaSO_4 . 2H_2O$ into insoluble $CaSO_4$ at 66 Cent.
$CaSO_4 . 2H_2O$ into soluble $CaSO_4$ at 89 Cent.
$CaSO_4 . 2H_2O$ into $CaSO_4 . \frac{1}{2}H_2O$ at 107 Cent.

The temperatures given by Van't Hoff are the theoretical transition points of the different modifications into the others; the conditions encountered in practice are much more complicated. The transition points are not sharply defined, taking place only gradually and slowly; several modifications subsist in a range in which only the others should be stable. The above data accordingly are only of slight importance in a practical sense in so far as an investigation of the setting conditions of plaster is concerned and the formulation of a theory explaining the interrelations of setting, temperature, duration of burning, etc.

Setting of the Semi-Hydrate (Plaster of Paris)

When the dehydrated gypsum of plaster of paris is examined under the microscope with drops of water, the following is observed: In from five to six minutes after the addition of the drop of water a lively crystallization sets in which is completed in from 30 to 40 minutes. The size of the needle shaped crystals increases with the disappearance of semi-hydrate $CaSO_4 . \frac{1}{2}H_2O$ which is the chief constituent of plaster of paris; the length of the crystals varies from 0.01 to 0.04 mm., their breadth is from 0.0017 to 0.0025 mm. Plaster of paris which has been burnt at 170 degrees Cent. for several hours crystallizes in three or four minutes and the whole process is completed in thirty minutes. The processes which can be observed under the microscope, that is to say hydration, solution and crystallization, also take place in the setting of plaster of paris. The completion of the setting corresponds to a complete conversion of the semi-hydrate into the di-hydrate. Presence of the insoluble or soluble anhydrite exerts an influence on the rapidity of the setting of the plaster of paris. The hardness of the final product depends on the form, size and density of the crystals. The smaller the amount of water used for gauging, the denser the casting will be. Further microscopic investigations have shown that a rhombic form of the di-hydrate is first produced which then passes over into a monoclinic one.

The phenomenon of the setting of plaster of paris is explained by the hydration of the semi-hydrate and formation of the hard di-hydrate $CaSO_4 . 2H_2O$. The semi-hydrate in this case is more soluble than the di-hydrate and as the first passes into solution the latter separates out into the hydration is completed:

*Translated from Zement.

$CaSO_4$ (hard) $CaSO_4$ $2H_2O$ (solution) $CaSO_4 . 2H_2O$ (hard)

The di-hydrate then crystallizes out from the super-saturated solution and the crystals grow together and partially form a solid solution. V. Glasenapp is of the opinion that in the setting of the plaster of paris obtained at 130 to 200 degrees Cent. the recrystallization of the semi-hydrate $CaSO_4.\frac{1}{2}H_2O$ which is more readily soluble in water into the di-hydrate $CaSO_4.2H_2O$ which is less soluble in water plays the chief role. This theory has been altered to a large extent of late as the result of the researches of Kavazzi, Traube, Wo, Ostwald, Wolski, Neuberg, Rewald and A. Baykow, who consider the setting of plaster of paris as a colloidal process. The calcined plaster when mixed with water forms a colloid, due to the swelling of the gypsum particles under the influence of the water, out of which needle shaped crystals grew later. A. Baykow maintains that all setting substances (also cement) unconditionally pass through a colloidal state even though after the completion of the process the solution consist only of crystal formations of a considerable solubility in water.

It has already been mentioned that there is an increase of volume in the setting of plaster of paris. Those in favor of the colloidal theory give as the explanation of this increase in volume the separation of crystals out of the coagulated gel.

The process of the hydration of plaster of paris is exothermic. Soon after mixing with water, in fact after about one or two minutes, there occurs a sudden rise of temperature (this moment corresponds to the hydration of the plaster of paris), then follows a slight drop in temperature (solution of the calcium sulphate) and finally a slow rise in temperature to about 20 degrees Cent. or more (there resulting the setting of the mass in the supersaturated solution); here the negative thermal effect of the solution is compensated by the greater thermal effect of the hydration of the plaster of paris.

Acceleration and Retarding of the Rapidity

A number of investigators have already taken up the study of the action of accelerators and retarders on the rapidity of setting. According to Rehland the mechanism of the influence of the catalysts on the acceleration or retarding of the setting of the plaster of paris is explained by the greater or lesser pressure of the solutions of those substances which exert a hydrating action in the salt solutions.

A change in the rapidity of the hydration depends not only on the nature of the dissolved substance, but also on the degree of concentration. According to Rehland, substances which further the solution of the gypsum act as accelerators, while those which diminish the solubility act as retarders. According to other investigators varying electropositive elements have an unusual action; in the case of one and the same base the salts with the stronger acids act most strongly. Electroposi-elements especially give rise to such phenomena; the strongest bases have the most accelerating action.

According to Traube the setting process of plaster of paris can be accelerated by the addition of electrolyte and retarded by the presence of colloids. An especially rapid setting is brought about by monovalent ions; anions are of subordinate importance. Bivalent actions have a retarding influence.

The investigations of the author on the influence of normal and molar acid solutions, their sodium salts, the salts of mono-, di- and tri-valent metals, complex salts and bases, on the rapidity of the setting of plaster of Paris according to the thermal effect brought the conclusion that sulphuric, nitric, hydrochloric and tartaric acids are accelerators. Their catalytic action can be given in the following order:

$$H_2SO_4 > HNO_3 = HCl > C_4H_6O_6$$

According to the author's results phosphoric, lactic, boric, formic, acetic and citric acids are retarders. The intensity of their action is in the following order:

Citric acid, acetic acid, formic acid, phosphoric acid, boric acid, lactic aid.

The negative action of the organic acids increases with the size and complication of their molecule. Lactic acid proves an exception.

The sodium salts have been selected in order to determine the parallel relation of the active acid anion in acid solution (solutions of the acids) as well as in neutral or slightly alkaline media (solutions of the sodium salts). The 23 curves obtained bring out the fact that the sodium salts of sulphuric, hydrochloric, nitric, hydrobromic, chloric and thiosulphuric acids facilitates the setting and are consequently to be reckoned among the positive catalysts. Their intensity of action can be given in the following order:

$$NaCl=NaNO3>NaBr>NaClO_3>Na_2S_2O_3 > Na_2SO_4.$$

In this way the positive properties of the salts named decrease with the increase in molecular weight. Sodium sulphate forms an exception.

The sodium salts of sulphurous, citric, tartaric, lactic, phosphoric and acetic acids are retarders. They come in the same order as the free acids.

Sodium tartrate, sodium citrate, sodium acetate, tri sodium phosphate, sodium lactate.

Experiments made by the author with molar, normal and deci-normal solutions of carboxylic acids have shown that their negative action on the rapidity of the setting of plaster of Paris is so great that already a tenth-normal solution of the

salts of these acids does not allow a second rise in temperature. In a trial made with a tenth-normal solution of sodium lactate a second rise of temperature was observed. The plaster mass in all cases had not set and only after 24 hours was an appreciable hardening to be noted. The strength of the test samples obtained exceeded several times that of those prepared with positive catalysts or with pure water. In the trial with tenth-normal sodium lactate solution the mass of plaster had set although the upper layer was still sticky and soft. Sodium acetate has a disintegrating action on the mass and the same remains soft even after several days. With sodium phosphate the plaster of Paris does not harden and is covered on the surface with a fine crystalline granular layer. As the result of the trials it is not possible to say that negative catalysts increase the strength of the plaster when set.

Salts of monovalent metals can, by their action on the rapidity of the setting of plaster of paris, be classed among the strong positive catalysts and according to their rapidity of action they can be arranged in the following order:

$$(NH_4)_2SO_4 — SO_4 = KNO_6 — KCl — K_2SO_4 = LiSO_4$$
$$NH_4Cl > AgNO_3$$

Consideration of the optimum temperature effects in the second rise, and consideration of the interval of time from the commencement of the experiment to the moment of setting, brings out the conclusion that the catalytic nature of the salts $(NH_4)_2SO_4$, KNO_3, KCl, K_2SO_4 and $LiSO_4$ are co-equal.

The salts of the divalent metals on the basis of the data obtained can be placed in the following order:

$$CdSO_4 > CuSO_4 > ZnSO_4 > NiSO_4 >$$
$$FeSO_4\ MgSO_4 > Ca(NO_3)_2.$$

Leaving out of consideration the common acid anion (with the exception of the last) a new series can be put up which throws light on the accelerating action of the divalent cations:

$$Cd''\ Cu''\ Zn''\ Mn''\ Ni''\ Fe''\ Mg''.$$

The salts of the alkaline earth metals have been put into a special group on account of the different acid anion and differing concentration of solution. In the classification of the three alkaline earth metals according to the strength of their catalytic action a start was made from normal solutions. The following order was arrived at:

$$CaCl_2 > BaCl_2 > SrCl_2 \text{ or } Ca'' > Ba'' > Cr''.$$

On the basis of the results obtained the following can be concluded: 1. The divalent metals with sulphuric acid anion differ little from one another and are to be classed among the strong accelerators. 2. The optimum thermal effects in the second rise of temperature with the same divalent cations stand very close to the thermal effects of the corresponding salts of the monovalent metals. 3. In the case of the alkaline earth metals with the chlorine anion the catalytic effect appears in a less prominent manner.

Barium chloride can be reckoned among the positive catalysts. From the comparison with the results of experiments with the molar and the normal solution of calcium chloride the result can be drawn that this salt is a weak accelerator. In a molar solution, indeed, it acts as a very weak retarder with a slight negative effect. Strontium chloride is a strong retarder and this is especially apparent with the molar solution; only after the lapse of one and one-half hours is slight rise in temperature noted.

The slightly marked thermal effect of the setting can be explained by transpositions with formation of barium sulphate or strontium sulphate, these being less soluble salts.

The salts of the trivalent metals give the following series for molar solutions:

$$Al_2(SO_4)_3 > Cr_2(SO_4)_3 > Fe_2(SO_4)_3, \text{ or}$$
$$Al''' > Cr''' > Fe'''$$

For normal solutions:

$$Fe_2(CO_4)_3 > Cr_2(SO_4)_3 > Al_2(SO_4)_3, \text{ or}$$
$$Fe''' > Cr''' > Al'''$$

From the results obtained it is concluded that the molar solutions of the sulphates of aluminum, iron (ferric) and chromium act as strong retarders in the setting process of plaster of paris.

In the case of the normal solutions of these salts the retarding action is greatly decreased; the normal solution of aluminum sulphate acts as an accelerator. The negative action of the molar solution of iron, aluminium and chromium can be explained by the fact that the hydrates of aluminium, iron and chromium forming in their nature of colloids strongly depress the setting rapidity of the semi-hydrate, in this case nullifying the positive action of the free sulphuric acid.

The complex salts, potassium ferrocyanide, potassium ferricyanide, ferric ammonium sulphate and ammonia alum, as shown by the curves plotted, are rather strong accelerators. A particularly strong positive effect is noted in the case of the two first-mentioned salts. According to the strength of their catalytic action they can be classified in the following order:

$$K_3Fe(CN)_6\ K_4Fe(CN)_6\ NH_4AlCO_4\ NH_4FeSO_4.$$

The normal solutions of the complex salts according to their thermal effects and above all according to the character of the thermal curves closely approach the action of the molar solutions of sulphuric and hydrochloric acids.

Of the strong alkalies, potassium, sodium and lithium hydroxides were chosen, of the weaker, a saturated solution of calcium hydroxide and a molar solution of ammonia. On the basis of the results obtained the alkalies can be arranged in the

following order according to the intensity of their catalytic nature:

$$KOH > NaOH > LiOH > NH_4OH, \text{ or}$$
$$K' > Na' > Li' > NH_4' >.$$

The results obtained allow the conclusion to be drawn that the molar solutions of the hydroxides of potassium, sodium and lithium must be considered as accelerators. The experiments with molar and with tenth-normal solutions of ammonia characterized this as a strong retarder. Calcium hydrate acts as a negative catalyst.

Hydration of the Insoluble Anhydrite

The author's experiments have shown that the hydration of the insoluble anhydrite can be brought about by the most varying substances. The presence of alkalies, acids, neutral and acid salts accelerate this process. The greatest hydration in a given space of time is brought about by an addition of sodium hydrogen sulphate. The size of the particles in this case is highly important; the greater the intensity of the grinding the stronger the action of the added substance will be. The acid salts do not require such a fine state of subdivision as the alkalies or neutral salts. All additions which bring about the hydration of the insoluble anhydrite act catalytically. The anhydrite in the presence of water and a salt apparently forms an unstable complex hydrate on the surface of its particles.

$$(Calt).MCaSO_4.NH_2O.$$

drate. Following the first process of hydration is drate.[2] Following the first process of hydration is a second of setting. It is, however, impossible to explain the setting process by the hydration alone, an important role is here played, apparently, by recrystallization. The experiments show that the catalyst added in the course of time will separate out in the form of a thin layer on the surface of the solidified mass. The suppression of this undesirable efflorescence has been carried out successfully by the employment of a combination catalyst, sodium bisulphate (0.4 to 0.5 per cent of the weight of the anhydrite) with copper sulphate (0.8 per cent of the weight of the anhydrite). As a starting material finely ground natural anhydrite can be used; better results, however, are obtained by the use of a dead burnt plaster produced at a temperature between 600 and 700 degrees Cent. with four to five hours burning. The catalyst can be added either in the process of grinding the dead burnt plaster, or it can be added to the water used in the gauging. The strength of the solution of the combination catalyst is made up to 8½ degrees Baume. The quantity of water taken usually runs to 30 per cent. The fineness of the grinding of the dead burnt plaster should correspond to a residue of from 20 to 25 per cent when passed through a sieve of 4900 mesh per square centimeter. As a starting material old plaster moulds of the terra cotta industry have been used with success, having been burnt at a temperature of from 600 to 700 degrees Cent. In all cases it is feasible to add to the anhydrite cement sand, color, turf, asbestos, iron borings and other substances. The anhydrite cement can be combined with magnesite cement. Pure anhydrite cement (without additions) attains a strength of from 40 to 68 kilogrammes per square centimeter after 28 days, depending on the fineness of grinding, the quantity of water and of catalyst, the intensity of burning, the purity of the raw materials, etc. The transitive strength attains 60 kilogrammes per square centimeter. It is a matter of great importance that there be no formation of calcium sulphide in the burning of the gypsum for the production of the anhydrite cement and that there be not over 0.2 to 0.3 per cent of calcium oxide.

Building Material Prices Drop

Prices of building materials during April were the lowest for that month in several years past, it is revealed by a study of data just gathered by the U. S. Labor Department. Materials costing on the average $100 in April 1923, were purchased for $80 this year, the Labor data indicate. In 1927 they cost $82. In 1926 the price was $86 and in 1925 it was approximately $87.

Lumber, brick, cement, steel and many other materials are included in the survey. Prices of these commodities in representative markets throughout the country are ascertained by the Department.

Prices of lumber and paint materials show the heaviest decline from the 1927 level. Lumber is shown to be approximately 8 per cent cheaper than last year. Paints are costing in the neighborhood of 7 per cent less. Brick has decreased 1 per cent, while cement and steel remain practically the same. The average drop for the entire group is 3 per cent.

In contrast to the price trend of building materials, the price average of the 550 commodities of all classes which make up the general wholesale index has risen 4 per cent since a year ago.

American Concrete Institute Sets Convention Date

The 25th annual convention of the American Concrete Institute will be held in Detroit, (headquarters Book-Cadillac hotel) Tuesday, Wednesday and Thursday, February 12, 13 and 14, 1929. Preparation of a program of eight technical sessions is already under way.

PRODUCES 1000 YARDS PER DAY ECONOMICALLY

By John O. Durkee

THE plant of the Dayton Gravel and Sand Corporation is located on the Baltimore and Ohio Railroad near Dayton, Ohio. It was designed by the Welch Engineering Company and is being operated by the Dayton Company almost to capacity. The present production of finished material is 1000 yards per day which consists of sand and pebbles, ¾, 1 and 1½ inch gravel; and 1 and 1½ inch crushed stone. The bins are so arranged that material may be loaded on railroad cars or trucks and it may be combined to meet the demand of mixed sizes as required. All chutes and parts of the plant exposed to abrasion are lined with Strenes metal, a product of the Advance Foundry Company.

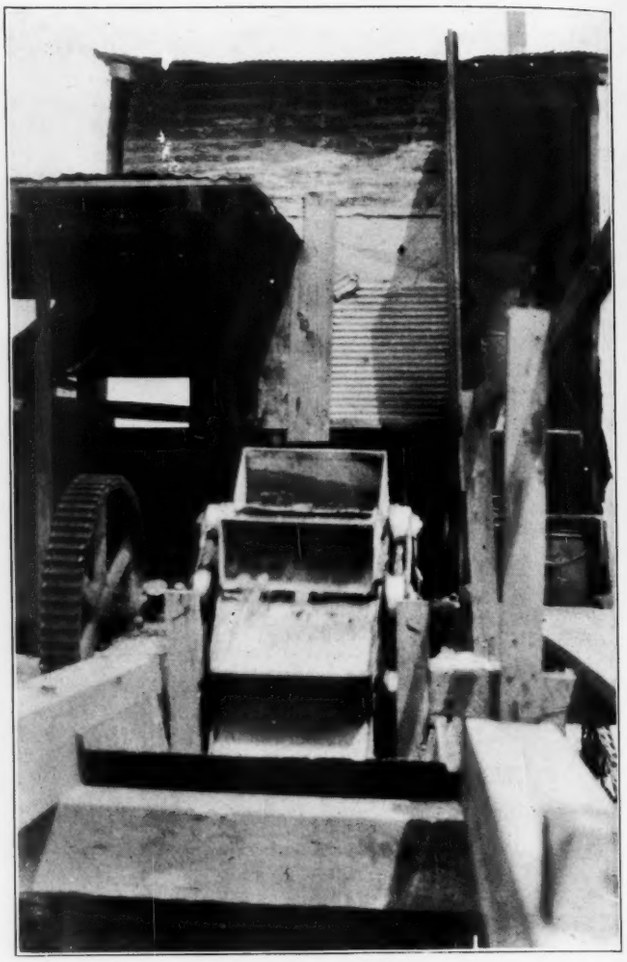
The material is excavated through the nozzle of a 10 inch Amsco pump located on a barge and driven by a 350 h.p. 440 volt a.c. ball-bearing Fairbanks-Morse motor. The sand and gravel is loosened and fed to the nozzle by a Swintek agitator, built by the Eagle Iron Works and the Amsco pump is primed by a Plat priming pump. The priming pump, agitator and Byers hoist are driven through friction clutches by an Allis Chalmers motor.

The sump, into which the material is discharged, is at present 725 feet from the barge with the distance continually increasing. The Dayton Corporation has acquired a large tract of gravel bearing land and operations at the present site will of necessity continue for a number of years. A greater distance between the barge and the sump is being created daily.

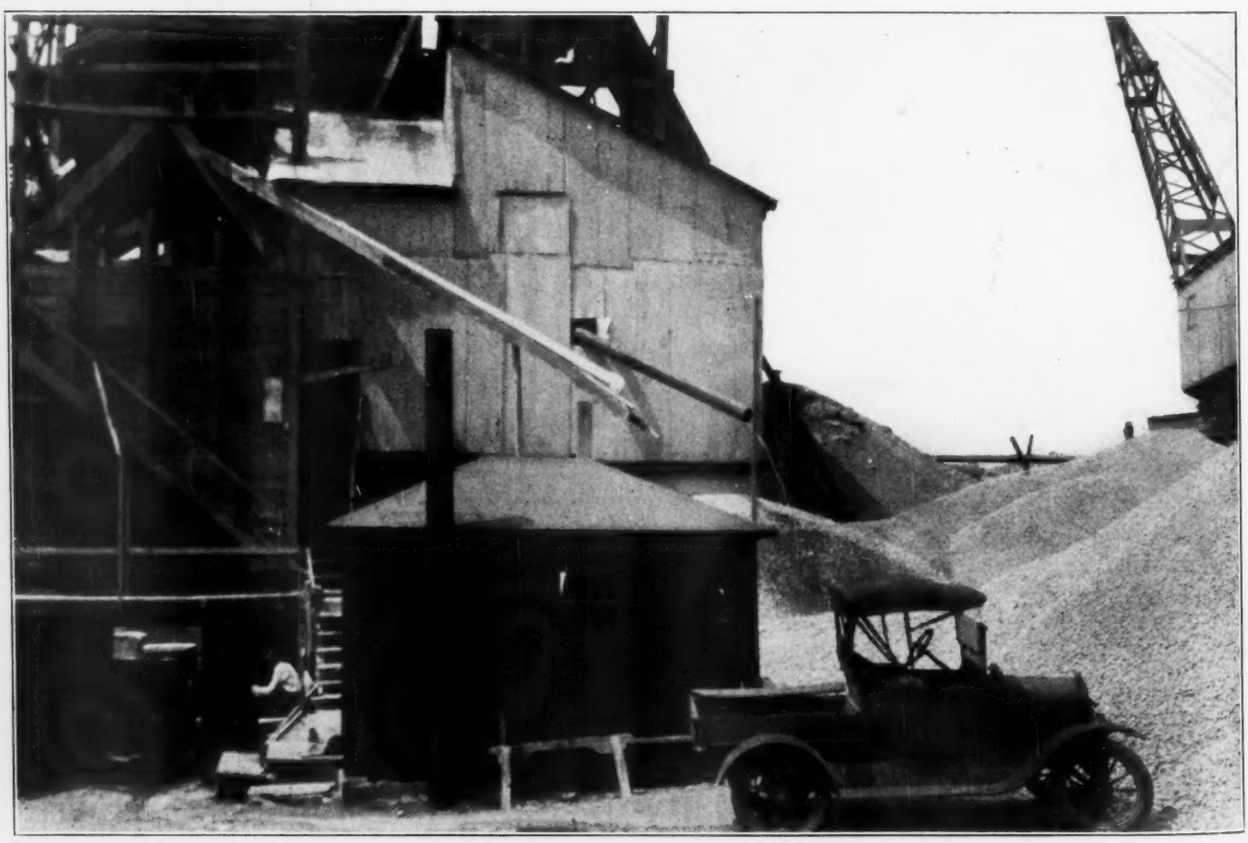
A model 70 Wiley Whirley dragline, built by the Dayton Whirley Company is located between the sump and the screening plant, as shown in the illustration. It is equipped with a 70 foot boom and Leschen red strand Hercules rope on which a 2¼ yard dragline bucket operates. The main engine is driven by a 60 h.p., 3 phase, 60 cycle, 440 volt special Lincoln electric motor. The front drum develops 20,000 pounds single line pull at 85 f.p.m. and the middle and rear drums develop 10,000 pounds single line pull at 170 f.p.m. A Fairbanks-

Whirley Dumping Bucket into Hopper. Note Its Position on Gravel, Supported by Timbers

Revolving Screen



Greenville Elevator Returning Stone to Screen



Showing Plant Building, Which Houses Screens and Crushers, and Loading Bins.

Morse 25 h.p. ball bearing motor operates the swinger.

The vertical distance from the sump to the top of the screening, washing and crushing plant is 85 feet where the material is dumped from the bucket into a hopper. It is then fed to a triple jacket 48 inch by 18 foot Greenville revolving screen, where the water for washing enters to begin the cleaning and refining process. All 1½ and ¾ inch gravel and sand pass to the bins. Sizes over 1½ to 3 inches pass by gravity to a Number 5 Austin crusher and sizes above 3 inch, or tailings, go to a Number 36 Symons crusher and the crushed material converges in a hopper. From the hopper, it is taken by a Greenville elevator operating on 45 foot centers and carrying 12 by 20 inch buckets to a triple jacket Greenville revolving stone screen, from which the 1½ and 1 inch crushed stone passes to the stone bins.

All crushers are operated from a line shaft which is driven by a 90 h.p. ball-bearing, 3 phase, 60 cycle, a.c. Fairbanks-Morse squirrel cage motor. The screens and elevator are driven by a 15 h.p. Watkins induction motor.

Officials of the Dayton Gravel and Sand Corporation include Clifton Hoolihan, president; H. A. Arnold, vice president; E. W. Campbell, treasurer and general manager; and Jacob Iler, superintendent.

Gypsum Association Suspends Activities

The Gypsum Industries was organized about 15 years ago. It originally was a voluntary association of gypsum producers. Its membership comprised all of the important gypsum companies in the United States and Canada. In 1923 the Gypsum Industries was incorporated under the laws of the State of Illinois. The management was vested in a board of directors and offices were maintained in the City of Chicago.

The activities of The Gypsum Industries were for the purpose of advancing or promoting the use of gypsum products by research, publicity and activities of like character; to deal with engineering and trade problems pertinent to the industry for the purpose of advancing the use of gypsum products; to carry on educational work pertinent to the industry by fellowships in schools and colleges for research; to maintain a traffic bureau to furnish traffic information to assist the industry in transportation questions before federal and state commissions and other bodies dealing with questions of transportation and with common carriers; and to maintain a credit bureau for the sole purpose of furnishing credit information.

Herschel H. Macdonald was the secretary of The Gypsum Industries for nearly its entire life. He resigned on January 21, 1928. The Engineering Department was in charge of Virgil G. Marani up to the time of his death in 1925. He was succeeded by Henry J. Schweim, who also assumed the duties of secretary upon the resignation of Mr. Macdonald. The Traffic Department was headed by W. J. Fitzgerald. George A. Olson, an agronomist, was in charge of the Agricultural Department.

All of the above activities were aggressively and successfully carried on by The Gypsum Industries. Much data and information of great value to the industry was collected and compiled in all of the several fields of activity engaged in by the organization.

Two research associates were maintained at the Bureau of Standards. The Gypsum Industries held membership in the American Society for Testing Materials, National Fire Protection Association, American Concrete Institute, Building Officials Conference of America, Pacific Coast Building Officials Conference and similar national organizations.

Severe competitive conditions in the industry have caused The Gypsum Industries to lose the support of several of its members by resignation thus making the financial burden for this co-operative effort too great for the remaining members to carry. At a meeting held in April it was therefore voted to suspend activities. When the present conditions are alleviated it is quite certain that the activities of The Gypsum Industries will be resumed.

Income Tax Analyzed

Income tax collections for the first nine months of the fiscal year 1928 were at the rate of approximately $13.46 for each resident of the country, it is revealed by a study of data prepared by the U. S. Treasury Department. This is $ .50 less than the average for the corresponding period in 1927, when $13.96 per inhabitant was collected.

Delaware this year leads all other states. Residents of that state paid an average of $57.85 this year. Collections in New York state were $40.89 for each person in its population. Michigan, with a per capita payment of $20.64, was third; Illinois, $19.95, fourth; California, $18.84, fifth, and Massachusetts, $17.09, sixth.

Collections were lowest in South and North Dakota. Residents of these states paid $ .75 and $ .94, respectively. The average in Mississippi was $1.12, and in South Carolina and New Mexico, $1.48 each.

The averages shown represent the total income tax payments for each state as reported by the Treasury Department, divided by the U. S. Census estimates of state populations in 1928.

PRODUCING TALC ECONOMICALLY IN NEW YORK

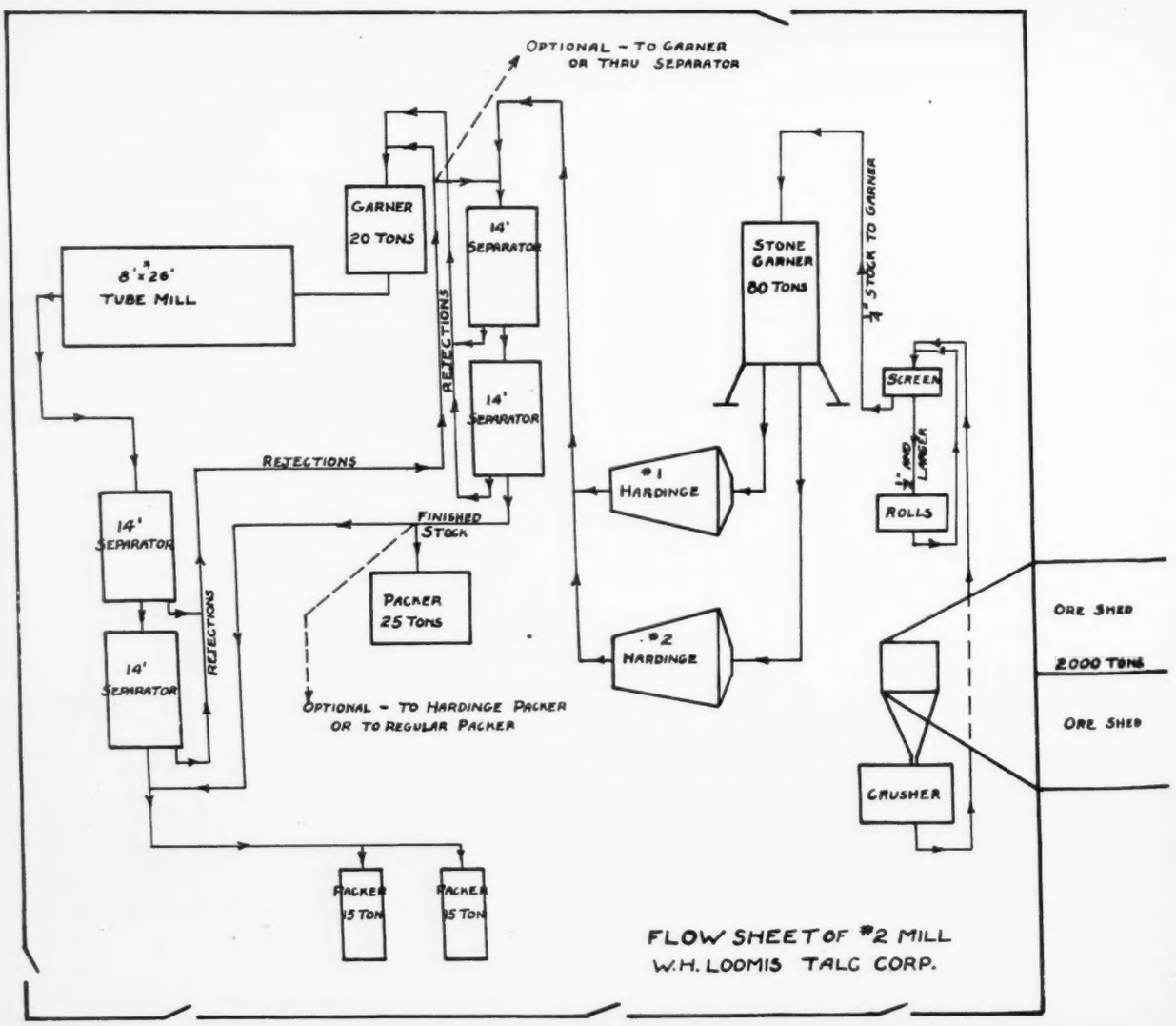
THE plant of the W. H. Loomis Talc Corporation, consisting of two mills, is located at Gouverneur, St. Lawrence County, New York. The building which houses the larger or Number 2 mill is 100 by 160 feet. A 60 by 150 foot storehouse has just been completed which gives 300 feet of loading space at the new mill. This plant carries, including officials, from 100 to 120 employees.

According to available information, this particular section of New York is producing the only short fiber talc that is being commercially mined in the United States. The operations were started in June 1921 and have progressed rather ideally since that period by developing a large area of raw material, adding new equipment, as required, and starting an additional mill in 1923, bringing the ground talc production up to 100 tons per day.

In December 1927, the office force moved into a new building at Depot and East Main Streets. This building is of considerable interest as it is an experiment in the use of talc for the building trade. The concrete foundation is water proofed with talc and the stucco work is talc with white cement. The fireplace in the office of the president was constructed of brick made from talc and white cement splashed with talc pebbles and the chimney was built of crude talc as it is produced in the mine. The floors are of cement with talc aggregate and the plastering is talc with white cement. The flooring is made by the United States Rubber Company with the edges exposed. The first coat of paint is talc and oil and all paint contains talc as a suspension agent.

The talc which is being mined is a magnesium silicate with a hardness of from 3 to 4 per cent, and the short fibers are readily distinguishable. The color is a pure white, which is of considerable importance when its many and various uses are considered. The life of the operation, based on present capacity, should extend from 200 to 300 years. The seam pitches from Northeast to Southwest and lies on a 45 to 60 degree pitch.

Talc recovery in St. Lawrence County is accomplished by underground mining and the Number 1 mine is down eight levels with 75 feet between



The Office Building of Loomis Talc Corporation

each level. The entrance for workmen is by a slope while the material is hoisted at a perpendicular shaft.

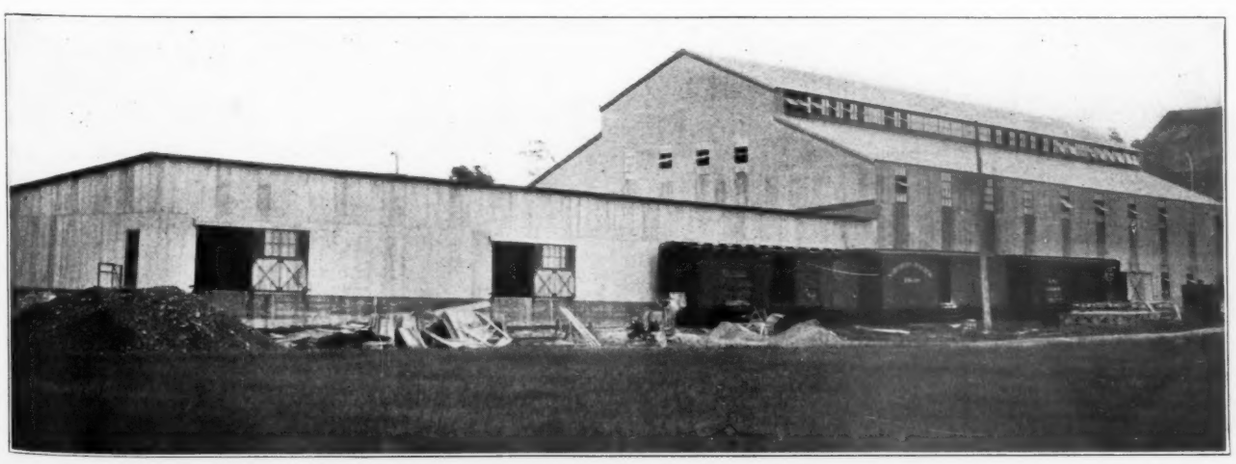
Drilling is done with jackhammer drills, driven with compressed air and the blasting is done with 40 per cent gelatin dynamite. The rock is loaded into cars by hand and hauled to the shaft bottom where it is hoisted to the top house. It is then sorted by hand for color and other characteristics such as are demanded by the various industries served.

Thi present system of mining will be considerably changed and improved. Preparations are being made and some of the preliminary work has been done to so arrange the haulage system that all the hauling will be done on the eighth level at the beginning of next year. Rock from the sixth and seventh levels will be dumped into pockets made from raises in the seam and drawn through chutes into cars on the eighth level.

From the top house, the crude rock is taken a distance of two miles to the mills by teams. The team haul has one advantage; it gives the rock, which contains about 7 per cent water, the required time to reduce the moisture content before entering the mill. This increases the grinding capacity of the mill from 20 to 30 per cent.

The crude rock is unloaded from the wagons into the receiving bins of 1500 tons capacity which have an angle of 30 degrees. From the bins, it is fed by gravity to a 9 by 10 inch jaw crusher and broken to 1½ inch maximum size. The crushed rock is elevated to a ½ inch mesh revolving screen and the oversize is returned to a pair of 16 by 36 inch Allis Chalmers roll crushers.

After the material passes through these rolls it is again returned to the ½ inch screen and the fines pass to a belt and cup elevator and are carried



Mill of Loomis Talc Corporation

to the top of the mill to flow into the hopper for the screw conveyors and taken by them to an 80 ton storage bin. From here the stock is fed to a continuous feed 8 foot by 48 inch Hardinge conical mill.

As the talc is discharged from the mill, it is elevated to the Gayco Emerick separators and the 325 mesh fines are conveyed to the packer bin while the tailings pass to a garner. These tailings are fed to an 8 foot by 26 inch tube mill by a screw conveyor and conveyed by elevators to two 14 foot Gayco Emerick separators. The finished product from these separators is elevated to two 20 ton gainers and the tailings, after being reseparated are returned to the garner at the feed end of the tub mill for regrinding.

The company has a laboratory on the premises and a force of men to constantly experiment and develop new uses for talc. After considerable research, talc has definitely been proved to be capable of waterproofing concrete and increasing the workability of the mixture. It is said to not only improve the appearance of a structure, but resists the action of acids which is of considerable value in concrete work where there is a possibility of weakening the structure by contact with acidulous air or mixtures.

P. C. A. Adopts Tariff Resolution

Whereas, Portland cement is on the free list of the existing tariff law, and the American Portland Cement Industry, operating 150 mills in 32 states of the United States and representing more than $600,000,000 in invested capital, is vitally affected by increasingly serious invasion of its home markets by cement manufactured by cheap foreign labor under low standards of living and general production costs that are much smaller, and

Whereas, the products of other important industries, likewise on the free list, are suffering similarly, both directly and indirectly affecting general national prosperity, thereby threatening American standards of living which it is the purpose of the tariff law to maintain, and creating a situation that strikingly emphasizes the need for prompt changes in the tariff structure by legislative aetion in Congress, and

Whereas, the national conventions of the major political parties will soon place before the electorate the platforms on which they will ask the return of their candidates in the forthcoming national elections, therefore be it

Resolved, that the Portland Cement Industry assembled in semi-annual meeting in New York City, May 23, 1928, regards prompt tariff revision by Congress as a national need of first importance and one which should be pledged by both parties in their political platforms.

Gasoline Consumption Increases

Gasoline is being used in 1928 at a rate approximately 13 per cent greater than in 1927, it is revealed by a study of data gathered by the U. S. Census Bureau. Monthly consumption this year is averaging 925,624,000 gallons, it is shown. Last year at the same season 820,288,000 gallons were being burned. The present rate is 220 per cent higher than in 1921, when 288,704,000 gallons were consumed monthly.

The 1928 consumption represents a monthly allowance of 40 gallons of gasoline for each of the 23,127,000 automobiles in the country, or a daily ration of 1.3 gallons. The 1927 allowance was 37 gallons per machine per month, or 1.2 gallons daily.

Average production in 1928 is shown to be approximately 1,174,572,000 gallons monthly. Stocks on hand are in the neighborhood of 3,280,000,000, or sufficient to maintain the nation's automobile traffic in motion at the present rate for about 44 days.

The usual seasonal increase in gasoline use is reflected this year in a rise of 130,000,000 gallons in monthly consumption since January. This indicates that motorists are taking advantage of the improved weather to obtain increased use and enjoyment from their machines.

Automobile Production Gains

Automobile production in the United States shows a monthly gain in 1928 over 1927, according to a review of the industry's output issued by the U. S. Commerce Department. The department's survey is based upon figures supplied by 160 manufacturers throughout the country.

The average monthly production of all cars in 1928 is shown to be 322,677. This is 3 per cent more than the monthly average for the same period in 1927 when 312,711 machines were produced. It is approximately 13 per cent below the output in 1926, however. Production in 1926 was the greatest in the history of the industry.

The gains made during the present year are confined to the pleasure car field. Output of this class of car in 1928 is revealed as 289,261 per month, compared with 269,911 in 1927, a gain of 7 per cent. Truck production over the same periods shows a decline of 22 per cent for the current year. The 1928 monthly truck average is 33,411 as against 42,800 in 1927. More trucks were produced in the first quarter of 1927 than in even the peak year of 1928.

Further gains in automobile output are forecast for 1928, based upon the belief that the usual seasonal decline in production will develop more slowly this year.

THE RECENT BLAST AT HAWKEYE QUARRIES

Showing Quarry Before Firing the Blast

ONE of the largest blasts, with reference to quantity of explosives used and amount of displacement, ever detonated in the Cedar Rapids, Iowa, territory, was recently exploded at the Number 2 Quarry of the Hawkeye Quarries Company at Glory, Iowa, on April 22, 1928. It consisted of 50 holes 36 feet deep and displaced in excess of 24,000 tons of stone. The ledge was sufficiently broken to make the rock of such size that most of it could be loaded into flat cars with steam shovels.

In the preparatory work, which was supervised by Lee Crawford, superintendent, the holes were drilled along the edge of the cliff by Armstrong all steel blast hole drills, driven by a multiple cylinder engine. The spacing of the holes was 9 by 12 feet to be sure that the burden on each hole would not be excessive as they were driven to a depth of 36 feet. The hole depth, spacing and charge were so calculated as to allow one pound of 50 per cent dynamite to each three tons of stone to be displaced. The dynamite was exploded by Number 8, 50 foot electric blasting caps, which were contacted with a direct current power line and the charges were exploded simultaneously.

The amount of rock, resulting from this blast, is estimated to be about one-fifth of the season's requirements and the blast was entirely satisfactory to all concerned. Most of the stone is used on public highways and for agricultural limestone.

Firing such a large battery of holes proved so successful that an additional thirty holes have been drilled, following a plan similar to the first experiment, using the same equipment and proportion of dynamite. These have been detonated and the result is that in excess of fifty thousand tons of stone are lying loose in the quarry to be crushed and refined for the uses to which they are particularly adapted.

New equipment has recently been installed at

View Taken During Blast

Displacement Effected by a Carefully Planned Blast

the Number 2 Quarry which is estimated to have cost $100,000 and together with the complete overhauling and adjustments have increased the capacity to 1,200 tons of finished material per day. Included in the new installations are a Number 9 crusher, a Number 2 gyratory crusher, a 36 inch jaw crusher, a belt conveyor, and scalper screens.

Hawkeye Quarries Company is a subsidiary of the Builders' Material Company with the principal office in Cedar Rapids, Iowa. The officers are: S. P. Moore, president; L. A. Moore, vice-president; and J. M. Woodside, secretary and treasurer.

Crushed Gypsum Pays Duty

Orders to assess duty on all gypsum which has been crushed after being quarried have been issued by the Bureau of Customs, according to an announcement from E. W. Cramp, Commissioner of Customs. In a letter addressed to the collector of customs in New York and mailed to all collectors, Mr. Cramp explained that the classification should be under paragraph 205 of the Act, rather than under the duty free sections which provide for the free entry of crude materials.

The letter sets forth that a firm of attorneys, representing certain gypsum producers in the United States, has protested against the admission of crushed, as crude gypsum and free of duty, as provided under paragraph 1643. They claimed that crushed gypsum is properly dutiable as ground gypsum under paragraph 205 of the tariff act of 1922, or alternatively under paragraph 214 of the same act, as an earthy or mineral substance wholly or partly manufactured.

The letter refers to the report of the supervising agent which points out that, formerly, gypsum rock was broken into pieces of a size that could be lifted and loaded by a man, but the investigation developed that the rock from several quarries is now being hauled to a crushing plant. This agrees with the 1926, "Report on the Mines," published by the Department of Public Works and Mines of Halifax, Nova Scotia, which gives the various methods at different quarries.

It states that "the gypsum of the Newark Plaster Company, which has a plant at Newark, New Jersey, passes through a crushed set at 2½ inches before shipment. It is then elevated and screened. The sizes ¼ inch and under are discarded and the oversize is conveyed to storage bins and shipped in crude form."

The letter implies that there does not appear to be any clear cut definition of the term "ground" so that it may be differentiated from "crushed" since paragraph 205 provides that ground or calcined gypsum shall be subject to a duty of $1.40 per ton and paragraph 1643 provides that crude gypsum shall be admitted free of duty.

The decision of the commissioner is in accordance with an order of the Governor General of Canada, according to the letter. It states that "broken gypsum rock, not ground, such as would pass through a ½ inch screen was properly dutiable under item 294 of the Canadian Customs Tariff as gypsum ground, not calcined." The order was based upon an appeal from the Canadian Board of Customs, which ruled that broken gypsum rock, not ground was free of duty as crude gypsum under item 292 of the Act.

In closing, the commissioner advises, "for the reasons stated, you are directed to assess with duty on ground gypsum under paragraph 205, gypsum which has been crushed after having been taken from the quarry. However, as it is now the practice to admit this gypsum free of duty, as crude gypsum, you should continue to pass it free of duty, if entered for consumption or withdrawn from the warehouse for consumption within 30 days after the date of this letter is published in Weekly Treasurers Decisions.

CLEANING UP AN ELECTRICAL POWER JOB

By George Ransom

WHEN a plant consists of a number of separate buildings the question of distributing electrical power from some central point necessarily becomes something of a problem. When the buildings are separated by good sized storage yards through which railroad tracks pass, as at the plant of the Vermont Marble Company at Proctor, Vermont, this problem becomes just so much more involved. In such circumstances we find aerial feeder lines crossing over buildings, yards and tracks, contributing a hazard to what stands below and themselves endangered by the possibility of fires in the buildings or mechanical failure due to accidents on the ground, sleet storms and so forth.

The Marble Company has just erected a new monumental finishing shop on the site of an old building over which an important group of power feeders crossed, some of them dropping down into the old building. Rather than continue this condition with its attendant hazards they have built a tunnel under the building. In this instance the company owns its own hydroelectric plant on Otter Creek, the station being at the bottom of the ravine immediately below the new mill. The power cables are brought up the bank to the mouth of the tunnel on poles, and are dead-ended on strain insulators attached to an I-beam at the entrance as shown in Figure 1. They then enter iron conduits supported on the wall as shown in Figure 2.

The tunnel itself is 6 feet high, 4 feet wide and about 250 feet long. Bolts have been set in the concrete of the side walls to which 2 inch by 4 inch studding is secured, which in turn supports the conduit as shown in Figure 2. Several of the circuits pass straight through the tunnel but others enter from it into the new mill overhead. All of the conduits have been bonded together and grounded.

Figure 2. Interior of Tunnel, Showing How Conduit is Supported on Sidewall

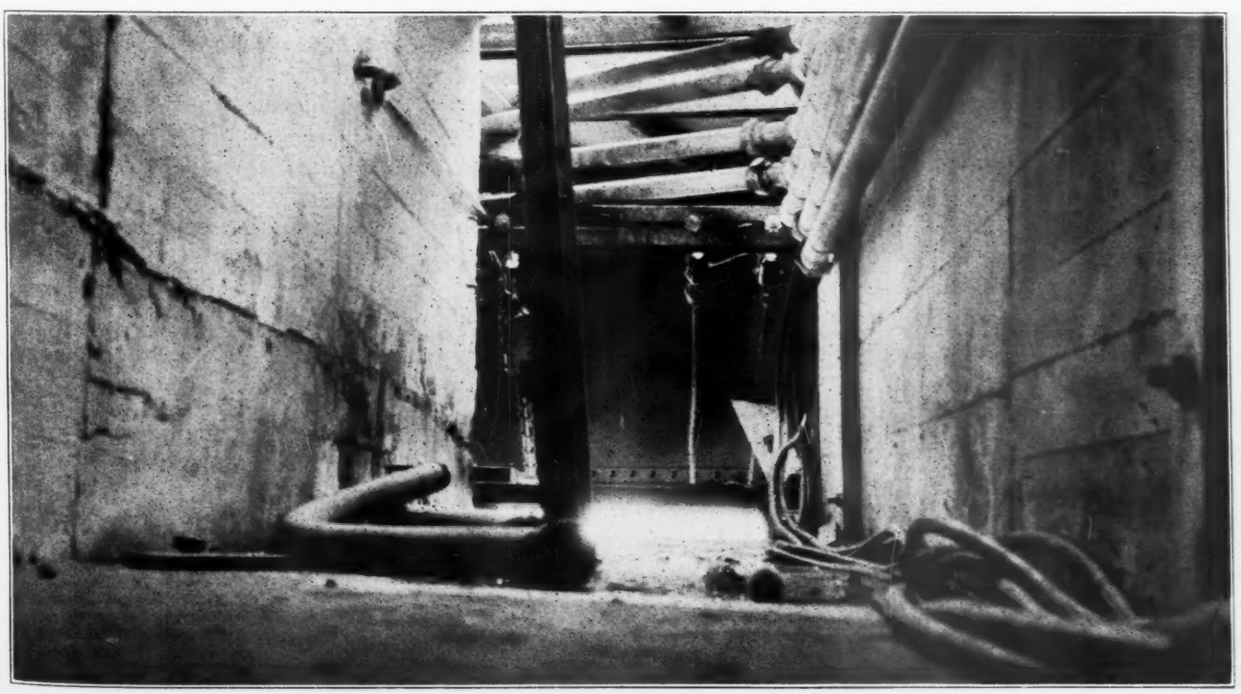
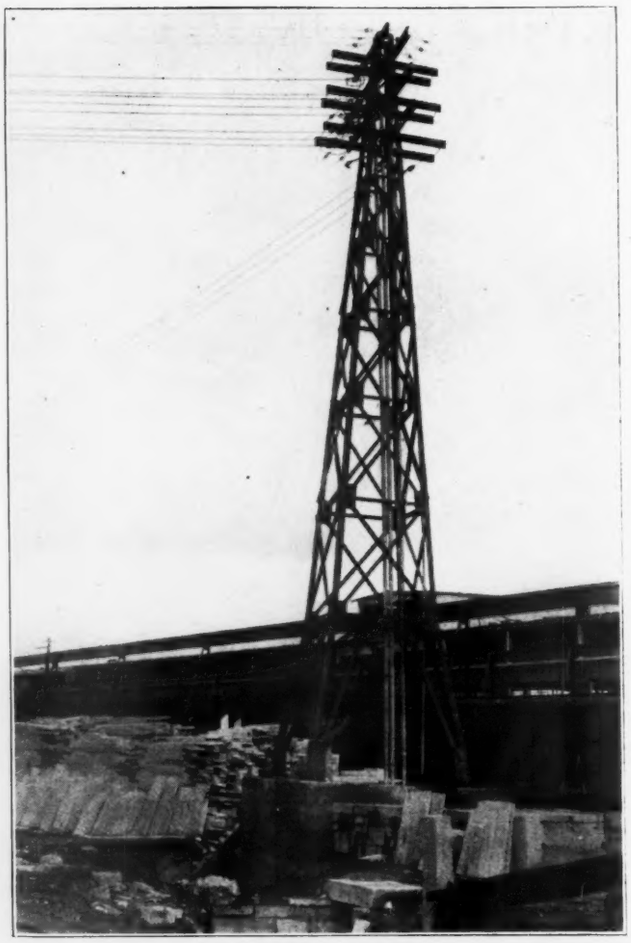


Figure 1. Entrance to Tunnel from Interior Showing Some Aerial Wires Dead Ended on Insulators



Steel Tower at End of Tunnel

At the other end of the tunnel there is a 45 foot self-supporting steel tower. It is situated some distance from the mill so that the tunnel passes under the main line of the Rutland Railroad on both sides of which the plant is located. Figure 3 shows a view of this steel tower. It will be seen that the conduits from the tunnel pass up the inside of the tower to the cross-arms and that the aerial conductors are dead-ended on 8 inch channel iron cross-arms. From this point on the wires are supported on four 35 foot Bates expanded steel poles which replace the old wooden poles.

This work constitutes one of those very satisfying clean-up jobs which become necessary every once in so often in all large well-kept plants. Growth, changes in location of machinery, yards and so on always seem to result in conditions periodically calling for these clean-ups. Plants where this is not done after a time get into a state where one wonders how the electrical department can ever keep things moving.

Proposed Highways in Mexico

Among the more important road construction proposals of recent date in Mexico are the following, which are said to have the support of the communities directly affected but which will probably not be carried into effect without Federal assistance: (1) Highway from Matamoros to Tampico, (2) Highway from Torreon to Monterey, (3) Highway from Nogales, Sonora, to Guarymas, via Hermosillo.

Road Transport Inquiry for England

An inquiry of far-reaching importance, covering the various aspects of road transport and the possibility of coordination between all means of internal transport in the United Kingdom, will be initiated under the direction of the Minister of Transport in order to ascertain the extent to which wasteful competition can be eliminated and yet preserve individual and private enterprise in this field.

The many aspects of the question, political and industrial, as set forth by the Minister, would involve such broad questions as the relations between masters and men and between private enterprise and state and municipal enterprise; indeed, the whole British internal life might come under review of the commission, for no reasonable aspect of the question would be eliminated from the wide circuit of the commission's discussion.

Other transport problems now before the country involve the possible removal of the Charing Cross Station to the south side of the Thames, thereby making room for a new double-deck bridge to relieve traffic congestion on the streets of London, as recommended in Lord Lee's "Report on the Thames Bridges."

The Minister of Transport is also sponsoring a bill before Parliament to enable weak bridges over railways and canals to be taken over by the local authorities, rebuilt, and made safe for the heaviest traffic. At present these bridges are great hindrances to road transportation, as literally hundreds of them are not strong enough to carry ordinary commercial traffic. With assistance from the road fund, the local authorities and the railways would be able to put these bridges in order, so that heavy freight and passenger vehicles would no longer find it necessary to detour 20 to 30 miles in order to cross bridges that are strong enough to carry the load.

Alumina

In producing alumina, materials such as clay, bauxite, leucite or phenolite are treated with acid such as H_2OSO_4, the insoluble, silicic acid is separated from the solution, the solution is evaporated, and the salts thus obtained are heated to decompose them into oxides and acids and the oxides are heated with a reducing agent, e. g., with C in an electric furnace to obtain Al_2O_3 and Fe and produce an easily separable metallic regulus. By use of diluted H_2SO_4 for treating bauxite, complete separation of titanic acid may be effected. I. G. Farbenind. A.-G. (British Patent 272, 748). October 20, 1926.

MINING OF GILSONITE IN UTAH

By W. J. Fene,
Associate Mining Engineer, Bureau of Mines

GILSONITE was discovered in the Ashley Valley in the Uintah Basin, Utah, several years after the first white men settled in the valley in 1878. The settlers discovered veins of a brilliant black substance in various parts of the basin. At first this substance was thought to be a variety of coal. When burned, however, it gave off large quantities of dense black smoke with a peculiar odor and instead of reducing to ashes the material melted and drew out into tarlike threads.

The first discovery was probably made in 1862 at what was then called Culmer vein, several miles south of the present site of the town of Myton in Duchesne County. Soon the Pariette mine was developed and the ore hauled to Price, Utah, the nearest railroad point.

Several years after opening the Culmer mine, a study of the substance was made by Professor W. P. Parker. He discovered that it was a member of the asphalt group and, as it was discovered on the Uintah Indian Reservation, he called it "Uintaite."

Samuel H. Gilson and Bert Seabolt became interested in these deposits and the former spent many years in his efforts to find a market for the Uintaite. His enthusiasm was regarded as more or less wasted by the people of the vicinity and the term "gilsonite" was locally applied to the Uintaite. When Gilson's efforts finally developed a market the name gilsonite had become firmly attached to this substance and it is now so known throughout the world.

Capital was obtained finally and filings were made on the Duchesne vein about 3½ miles east of Fort Duchesne. Lands in this vicinity were then on the Indian Reservation and it was not until 1888 that "The Strip" of 7,000 acres was opened for entry. The St. Louis mine was developed and for many years this was the principal source of gilsonite. The ore was hauled 75 miles to Price, Utah.

Mining was necessarily done rather crudely but enough ore was produced to supply the small demand and work was continued without interruption until 1893 when the explosive nature of gilsonite dust was accidentally discovered when some of the dust was ignited by candles. Several miners were injured, one fatally, and so much damage was done to the mine that the operations were not resumed until the following year. A few months later there was a second explosion, killing two men and setting fire to the ore in the mine. After raging unchecked for eight days the fire was finally smothered and the mine again operated.

Meanwhile, many larger veins in the eastern part of the basin had been discovered, and in the nineties the demand for gilsonite had increased so much that ore was hauled as far as 125 miles to the railroad.

About 1900 the St. Louis Co. was secured by the Barber Asphalt Paving Co. of Philadelphia and reorganized under the name of the Gilson Asphaltum Co. The Indian lands were thrown open and a wild scramble for gilsonite veins ensued. Owing to the expense of developing these properties few individuals were able to finance them and practically all of the land fell into the control of a few companies.

In 1902 the demand for gilsonite was so great that better, quicker, and more dependable methods of placing gilsonite on the market became necessary. The Black Dragon vein was developed and by 1904 enough ore was proved to warrant the construction by the Gilson Asphaltum Co. of a railway connecting the Dragon mine with the Denver and Rio Grande Railroad at Mack, Colo., and named the Uintah railway.

The Uintah railway is 55 miles long and is a marvel of engineering with very steep grades and sharp curves. It crosses the Book Cliffs at Baxter Pass, an elevation of 8,437 feet. The trains actually travel 24 miles between points only 6 miles distant by air line; 3 and 4 per cent grades abound and there are several miles of 5 per cent grade and an unbroken stretch of 7½ per cent grade. The shortest curves are 66°. The road is narrow-gauge and Shay engines haul four cars over the mountain and recently the largest Mallet engine ever built for narrow-gauge service was secured.

Explosion in Dragon Mine

In spite of every precaution there was an explosion on February 12, 1908. Two men were killed; thousands of dollars worth of damage resulted, the mine became practically a furnace and all of the lower workings were filled with melted gilsonite which solidified. Fourteen months later the bodies of the two victims were recovered and operations resumed. The fire was not completely extinguished and continued to smolder for many months with occasional periods of increased intensity during which the miners would become panic stricken and most of them would leave. In November 1910 flames again broke out but all of the miners were brought to the surface safely.

The fire was extinguished and the mine placed in operation within a few months. Mining under these conditions was so dangerous however that

in the spring of 1911 the property was abandoned and after considerable prospecting a site was chosen for a new mine on the Rainbow vein, 8 miles to the northwest.

During the summer the Uintah Railway was extended 9 miles along Evacuation Creek and a new terminus built at Watson. A 4-mile branch, climbing 850 feet and requiring a 5 per cent grade most of the way, was run to the ne mine at Rainbow.

Properties and Occurrence

Gilsonite occurs in the veins in a solid homogeneous mass and breaks with a conchoidal fracture. Even in the minutest pieces the brilliant fracture is preserved. Long exposure to the weather causes it to lose this brilliant black luster and it becomes dull and black. Occasionally it has a fine columnar structure at right angles to the walls. This is called "pencilated" ore and is frequently found on both sides of the vein. The veins outcrop on hilltops but elsewhere the ore is covered with 15 feet or more of soil.

The surface ore melts at about 400° and is used principally as a saturant of felt in the manufacture of roof and floor coverings. It is generally designated as White Label ore and with increasing depth it gradually becomes better in grade and is termed "select" grade about 50 feet beneath the surface at the Rainbow mine; but in places north of the White River "select" material is not found until a depth of 300 to 500 feet is reached. Select ore will melt at 275° F. and is used in the manufacture of high-grade paints, varnishes, and electric insulation. Although gilsonite lacks any elastic properties, it makes a varnish whose elasticity is remarkable. A thin piece of tin coated with good gilsonite varnish may be bent repeatedly without the coating being cracked.

Gilsonite is closely related to wurtzilite or elaterite and to ozocerite which is also found in the Uintah Basin. A kindred hydrocarbon, grahamite, is found in Oklahoma. Gilsonite is a black tarlike substance with a brilliant luster. Its specific gravity is 1.035, its hardness is 2, and the streak on a porcelain plate is brown. It is exceedingly brittle and during mining gives off clouds of chocolate brown dust which softens under the heat of the body and is very penetrating to the skin. It is insoluble in water and is removed from the body with difficulty. It is not affected by acids but is soluble in alcohol, turpentine, carbon bisulphide, heavy oils, and fats.

Its average composition and thermal value are:

Extent of Deposit

The Uintah Basin is approximately 170 miles from east to west and 100 miles from north to south. It is bounded on the west by the Wasatch Mountains and extends into Colorado about 50 miles in the direction of Meeker. On the north it is bounded by the Uinta Mountains and on the south by the Book Cliffs. This area of some 15,000 square miles contains a storehouse of asphaltum, asphaltic sandstone, and oil shale so large that expressed in figures it is staggering. The basin is a syncline formed by the upbending of the strata against the Uinta Mountains and is cut through the center by the deep gorge of the Green River which flows toward the south.

By far the greatest amount of gilsonite is found north of the White River where the Lower Uinta measures show less erosion. Three large and nearly parallel veins extend across the country in a N. 60° W. direction with a dip of nearly 90°. The Cowboy vein is the largest and has a maximum width of 18 feet for about 2 miles north of White River. This vein rapidly becomes narrower in both directions but is at least 10 feet wide for 3 or 4 miles and over 6 feet wide for several miles north of White River.

There are numerous veins in the basin and when one considers that 1 mile of the Cowboy vein in the widest place contains about 316,800 tons for each 100 feet in depth, the supply of gilsonite seems almost inexhaustible.

Composition of Gilsonite

	Per Cent
Carbon	88.3
Hydrogen	9.96
Sulphur	1.32
Ash	0.10
	99.68

Thermal Value

Calories	9,650
B. t. u.	17,370

Theory of Origin

Various theories have been advanced as to the formation of these veins. The claim that the source was in some overlying strata is without foundation in view of recent investigations. The most plausible theory appears to be that the formation of this great synclinal basin resulted in gigantic cranks in the brittle and nonelastic sandstone measures of the Uinta formation with enough heat to distill the oily matter in these carbonaceous measures from the underlying Green River shales.

Uses of Gilsonite

The higher grades of gilsonite are made into varnish, paint, electrical insulation, and inks for rotagravure sections of newspapers. The intermediate grade is used for such articles as telephone mouthpieces, switch handles, and knobs and buttons of various kinds. The poorer grade is used in the saturation of felt.

The ore found near the surface contains foreign matter, mostly silica, which renders it unfit for the best trade. It was formerly the practice to leave in the ground as pillars much of this surface ore, but recently the use of this quality of gilsonite for the saturation of felt has increased until it comprises one-half of the gilsonite ore shipped. The growth of foreign use of gilsonite has increased until one-fifth of the ore mined is consumed outside of the United States. The demand for gilsonite in England, France, Germany, Italy, Holland, Belgium, and Japan is steadily increasing.

A very small amount of foreign matter in a shipment of select ore will render it unsuitable for varnish so that the utmost care must be taken to prevent chips of rocks or grains of sand from getting into the high-grade ore.

At present there are three companies operating in the Watson, Utah, district. The Gilson Asphaltum Company, a subsidiary of the Barber Asphalt Company, operates the Rainbow mine with about 40 men for about 300 days a year. The American Asphalt Association is operating the Country Boy and Rector mines on the Dragon vein with approximately 50 men. Their output is considerably less than that of the Rainbow mine on account of poorer mining conditions and the necessity of trucking ore 3 to 5 miles. This company also mines small amounts of ore from holdings on the Cowboy vein. The Utah Gilsonite Company, operating the Little Emma Mine on the Uinta vein, employs about 10 men, transporting their ore by truck to Craig, Colo. The combined output of all the companies is about 130 tons daily.

Mining Methods

The method of mining used at Rainbow will be described as it is characteristic of that used at all gilsonite workings.

The mining of gilsonite unlike that of coal or other ores requires no elaborate surface plants for preparation. The gilsonite ore does not have to be prepared and as it is sacked and made ready for shipment in the mine the only loading equipment necessary is a platform from which the sacks of ore are transferred from the mine car to railroad cars.

The ore outcrops at the surface where mining is started and progresses inward and downward, all of the ore of the vein being removed. In working, a system of slopes and benches is used.

At the "Thimble Rock" operation of the Rainbow mine, a small gasoline hoist is employed to hoist the sacked ore to the tramway level. The hoist is so located and the sheave wheels so arranged that ore can be hoisted from any of the different shafts by moving the cable from one wheel to another. At the other operations, gasoline tractor-hoists are employed.

Due to the highly inflammable nature of gilsonite no attempt has been made to use explosives in mining. The ore is very brittle and a sharp pick can be driven into it easily. Trenches about 18 inches wide are dug along each side wall, thus releasing the pressure on the center of the mass so that the ore expands and breaks out of itself or can easily be picked out. The miners who dig the ore also do the sacking and place the sacks, three at a time, on the hoisting cable. The filled sacks weigh about 225 pounds and are sewed with different colored twine to distinguish the various grades. The gilsonite for foreign trade is shipped in double sacks. All mining is done by contract and each man mines about 5 tons receiving about $1.50 for each ton mined.

The walls are smooth and require little timbering except against the flaking off of small pieces. Occasionally, small veins of gilsonite parallel to the main vein expand after mining and loosen large sections of the wall, requiring much timbering to hold them in place. Horses or large pieces of country rock which may be attached to one or both walls or may be held in place by the ore are sometimes found in the vein. These are usually held in place by a pillar of ore below them, and as gilsonite will readily expand and fall it is essential that it be supported by timbers and lagging. The timbers used are about 8 inches in diameter and are hitched into the wall on one side and wedged on the other.

As the workings are open to the surface the use of lights is not necessary; the miners become accustomed to the semi-darkness and are able to work without artificial light.

Manways or ladderways are used to enter the different workings. Substantial ladders with landings every 12 feet are guarded by enclosures of heavy wire netting to prevent falling. The mine workings are well protected against falling material from the surface by means of wire netting placed along the tramway level. The Rainbow mine is the only gilsonite property with direct railroad connections. Also, it has always been the largest producer of gilsonite, about 75 per cent of all gilsonite produced coming from this mine.

Statistics of the Cement Industry

The ratio of the operations to the capacity of the American portland cement industry during the month of May was 86.6 per cent, according to figures recently released by the Bureau of Mines of the Department of Commerce. During the month 17,280,000 barrels were produced, 18,986,000 barrels were shipped, and there were in stocks on hand at the end of the month 25,921,000 barrels. Production in May, 1928 was 3.5 per cent more, and shipments about 12.6 per cent more, than in May, 1927. Stocks at the mills were 10.3 per cent higher than a year ago.

SILICA— ITS HISTORY AND RELATION TO INDUSTRY

By J. A. Bennell, President Crystal Silica Sand Company

ALCHEMY, Chemistry and Minerology are sciences bearing inter-dependent relationship to commercial and industrial progress. Therefore they manifest the necessity of constant research in order to co-ordinate the expansions that daily become factors in business adventure.

Silica, What Is It and Why?

Silica is as old as Mother Earth. In fact, it is a potent element, the master particle left after the mysterious upheaval, that binds the Earth in its multiplicity of structure that we commonly call "land, rocks and sands." Silica is the most widely distributed substance in the Earth. Its identity is found in the form of sand, quartz, gravel, and sandstone of practically every description. In fact, all are composed almost entirely of Silica. It also occurs in the granites, clays, slates, mica, feldspar and other rocks. It is found in the stalks of grasses, grains, flowers and other fibrous and tuber growth to which it imparts strength and toughness. It also imparts similar qualities to the quills of birds, fowls and to living sponges. Even the geysers and hot springs of our National Parks dissolve silica crystals and deposit it at the mouth of the springs as they evaporate.

Silica occurs both in crystaline and in amorphous (or irregular) forms, and is therefore without definite structure. Amorphous Silica is a soft white substance, insoluble in water and impervious to acids. Quartz and crystal grains are the best examples of crystalized silica and take a major position in commercial and chemical history. Precious stones, such as amethyst, jasper, catseyes, opals, onyx, agate, chalcedony, and perhaps the marbles, are either of crystalized silica or amorphous silica, or both, giving the delicate and beautiful coloring in various shades and tints that we observe in precious stone marts, admire, buy and know little of their origin.

A word about silicon might be of interest at this point. Silicon, being the natural non-deformed Silica, or Silicon Oxide, is of course the principal constituent of sands, quartz, flints and many of the rocks, invariably occurring in the form of crystals, and is therefore really the Mother element of the stone, sand and quartz formations.

Modern geology tells us the story of the ancients to the effect that in the making of the world there were four substancs from which all things were created—Earth, Air, Fire and Water—but in their effort to disseminate the relative effects, the philosopher and sage of this group of ancient chemists determined by test that fire was not a substance, therefore handed down to us of this modern century the knowledge that the world is formed of the other three, known in modern geology as — Atmosphere (air), Hydrosphere (water), Lithosphere (rocks or earth). The story of the Earth, while vitally interesting, is a long story, therefore I will merely refer to the pertinent points related to my subject.

Scientists tell us that we live at the bottom of a great ocean of air extending upwards some 200 miles from sealevel. Its composit is principally oxygen, nitrogen, carbonic acid gas and water vapor, and is an important agency in changing the solids of the earth. Hydrosphere, or water, includes all the waters of the globe, and directly affects the erosion and escarping of rocks and earth, which is termed Lithosphere, or rock sphere, and which are the solids of the Earth, estimated at 8/9ths of the mass or crust; therefore it is with this mass that we will deal, because silica is the formative binder and, being the greatest abrasive known, is an important agency in the great periodical movements of the earth as a whole.

With the formative picture before you, I will endeavor to relieve the effect of "sleeping sickness," —because I appreciate how dry the subject is—by going directly into Silica history and its relation to modern business, which is your paramount interest and mine.

The analogy of geological history and scientific research as it relates to the discovery, development and processing of silica in its variety and multifarious applications, has passed the acid test of time, and each year new uses are found for this very formidable non-metallic, which in reality is only sand but with such reactionary chemical influences that it is too "highbrow" to be termed Sand, without using the word "silica." Therefore we will deal kindly with nomenclature and call it Silica Sand, the kind of minerals that has found its place in our industrial Sun, and getting better as time goes by.

Silica, before man knew what it was, and long before the element was isolated, was used as flints and arrowheads in this country by the Indians. It supercedes the Iron Age. Its commercial uses antidate steam, matches and grinding.

Far back in the almost prehistoric age, it is found as the binder and abrasive element in the pyramids of Egypt, which today stand among the wonders of the world, impervious to time and the effect of ages.

Then, too, modern man found Tut's Tomb, and that crypt is almost wholly silica. Thus we had the silica age of ancient times, preceding the age of all development; and today in this modern age silica has naturally crept into a curiously important dominance in mechanics, physics, and the sciences of industry, the details of which are ramified and various.

The scintilating natural progress of Silica into business must be interesting to all of us who are engaged in business; and now that we are out of the geological gloom I shall endeavor to lay before you a simply business history of this worth-while element that is now the modern Sand of Time and most important in the progress of the ceramic and non-metallic industry, neither of which has been exploited beyond scratching the surface of the ever-growing public demand.

The dioxide of silicon, commonly called silica, is one of the greatest single constituents entering into our entire industrial structure. It is brought most clearly to the mind when we consider the various kinds of sand and its relation to industry. The major portion of all sand is silica, and should be the principal component part in building material.

As an abrasive for cutting, polishing and sand blasting, it serves a vital purpose in many industries. Even lumber is now being sand-blasted, to cut away the softer grains of wood, thus leaving the harder grains in relief. The resulting appearance, not only increases the beauty of the wood, but adds to it that element of antiquity. The common uses of Silica in the classified fields of endeavor should read about as follows:—

Chemical Industries

As a filtering medium.
In the manufacture of carborundum.

Paint

As an inert extender.

Mineral Fillers

As a wood filler.
As a filler in rubber, hard rubber, pressed and molded goods, phonograph records.

Ceramic Uses

In pottery industry as ingredient of bodies and glazes.

Insulation

Sound insulation in walls, between floors, etc.

Structural Materials

Sand-lime brick.

Optical Quartz

For the manufacture of lenses and accessories for optical apparatus.

Abrasive Uses

In scouring and polishing-soaps and powders.
In sandpaper.
In sand-blast work.
For sewing and polishing marble, granite, etc.
Tube mill grinding pebbles.
In tooth powders and pastes.

Refractory Uses

In making silica fire-brick and other refractories.

Metallurgical Uses

In making silicon, ferro-silicon alloys of other metals, such as copper.
As a flux in melting basic ores.
Foundry mold wash.
Foundry parting sand.

Water-glass, so widely used in many industries as a filler, is produced by the fusion of sodium and silica, which then becomes soluble in water.

As an essential to the application of electricity, silica is indispensable. Witness all electric light bulbs, of whatever nature, made of glass. We need not mention the fact of silica being the essential part of all glass. Neither is there any substitute for silica as a component part of the ignition systems in the application of electricity to industry.

Asbestos, which is playing an ever-increasing role in our commercial life, would be something else, excepting for the silica it contains.

In such a moderate climate as there is in California, where excessive freezing temperatures are absent, the stucco form of buildings is ever-increasing The stucco which stands up to the action of weathering must of course be composed of materials which are not soluble in water and as well be impervious to the various gases often carried in the atmosphere. For this reason sands of the highest silica contents are being sought, since the dioxide of silicon is impervious to all gases and water incident to any process of weathering. It is also rapidly being recognized that carbonates must be absent from durable building material. Silica alone offers the solution.

The conversion of the carbonates in the process of cement manufacture into a silicate is the indicator that silica is the base of durable and economical structure. Is not the concrete highway the best one? If the proper high content silica sand is used in concrete and properly mixed with reliable cement, then it is that the best roadbed is secured.

The oxy-chlorine cements—misnamed magnesite—when properly mixed with silica sand, together with the same sand from 100 to 400 mesh, used as a filler, gives to us, perhaps the finest of flooring material.

It is again revealed that when the calcium or magnesium of carbonates are introduced, the product does not stand the ravage of weathering. During the late war the Germans were able to mount

their "Big Berthas" at night and fire them the next night. It was revealed that their concrete bases were of Silica Oxy-chlorine process, setting in a few hours after being laid, were weatherproof and waterproof. There is no doubt, in my mind, that silica oxy-chlorine products will find a permanent place in Metropolitan Building Codes in a reasonable time.

With the ever-increasing demands upon the timber supply of our country the demand for silica in all its various forms will increase as a base for building material.

Silica, in the manufacture of paints, going through the process of experiment, with every opposition against silica fines in favor of lead—has won. Today Silica Fines is a predominating factor in the manufacture of commercial paints.

The soap industry has long since found silica an important element in the manufacture of heavy cleansing soap and soap powder. The same thing in sweeping compounds, etc. There is no end to the uses of silica, and the most amusing perhaps is the apartment house sands, commonly called "pet-sand" and the hotels that like to have it known as "cuspidor sand."

The greatest deposits of silica applied to industrial uses are found in Belgium and Germany. The next greatest deposits are in the United States—Illinois and New Jersey, and now in California. Belgium not only produces and exports silica but manufactures every known kind of glass and glassware. Germany likewise manufactures glass, and its ceramic production no doubt leads the world in quality and design. It was, however, left to the ingenuity of the American "Genus-Homo" to step into mechanics and develop mass glass production that today this country produces by mechanical process the finest glass products in the world. It is possible that the fine processing of silicon clay by our ceramic geniuses will in the near future produce the finest porcelain and china in the world.

Southern California is the logical producing center for glass products. It is no longer necessary to import silica, nor to ship it in from Eastern United States. We have in Southern California all of the raw materials necessary for glass-making, and our recent silica development in Crystal Sand, high silica content and low in iron oxide, is of enormous proportion and important in our scheme of things industrially.

Glass is so common in use that we pass it as an ordinary process in life. Yet glass adds more comfort and happiness to daily life than the costliest gems. It is indispensable in the home, the arts, and the commercial world. Glass is not a natural substance but is an artificial compound, made up of silica sand together with certain fluxing agencies in batch. The historical sphere of glass-making has long been lost in antiquity, but in the 17th century ground flint was used in the manufacture of glass by the Phoenicians, creating the term "flint glass." However, today flint is forgotten and only chemically pure silica sand is used. Iron oxide, being the deterrent in glass manufacture, it is the endeavor of modern producers of silica to mechanically lower the iron content.

Diligent research in silica sand production and uses has entirely exploded the old theory of high percentage of silica content sand for glass-making, as has also been exploded—that any old kind of silica sand will make glass. This research work has been carried on by no less an authority than the Hon. Percival Marson, of New Castle, England, —the greatest glass technologist and analyst in the world. I have just recently received a letter from Mr. Marson, going into lengthy detail of practice and procedure in glass-making.

The United States in 1926 did in dollars in glass $225,000,000—350 factories, 65,000 employes—capital invested $180,000,000. Therefore it is interesting to note just what the industry means to California from a production and distribution standpoint.

We can produce the silica soda-ash and carbon. Silica is within economic transportation—24 hours delivery—a white pure crystal, low in refraction, a better sand than Belgian and a standardized screen size that meets the needs of the glass manufacturer, who must be interested in not only a constant supply, but a product on a basis of price, quality and service. Crystal Silica Sand is being produced in California in a variety of screen sizes that best fit the requirements of every user. This I believe is the first attempt in the history of the business to provide the user with his best adaptable screen size. This required wide research and a study of standards, but it has been successfully accomplished.

Somewhere in the archives of the Southern California Chapter of the American Ceramic Society, there is a treatise on the "missing link" between the metallic and non-metallic minerals. This mineral I believe was named "Dynon." It is of steel hardness, will cut glass, and scratch anything but a diamond. This is the invention of Mr. Thos. E. Curtis of the Vitrofex Corporation, I believe. I have not had the pleasure of looking at "Dynon" but it is my humble opinion that it has silica in its compound. This opinion is based upon the fact that we produce a silica crystal that will not cut glass, scratch anything except a diamond and is steel hard—therefore I want to congratulate Mr. Curtis upon his research and discovery, which is certainly proof that research work means much to industry. More power to chemistry and research laboratories. Were it not for the research work throughout our industrial world, we would be without the gigantic steel industry, and without the steel industry we could not have modern trans-

portation. Wars would be horseplay—weapons, the "flint lock" — type, "flint" — there's silica again. Take the chemical research laboratory from any or every walk of business life in the United States today, and we go back 1000 years—and who of this generation, with that keen, lively aggressive American industrial spirit, wants to go backward?

It is now time to bring my subject to its local atmosphere—California—Southern California. May I ask, can there be a more interesting adventure for mankind than being a part of the natural resource development of this wonderful country? California abounds in natural resources, basic to industry, awaiting the touch of the hand of man.

California is the focal point in the decentralization of the industrial East, and the move of population is westward. All the natural advantages are to be found in California—the open door to the Great Orient and West Americas. California resources are of such variety that industrial self-containment is as near 100% as can be found anywhere in the world; but California must develop these resources. In my business endeavors I have tried to survey every trade angle and its relation to basic economics. A fundamental reason, so to speak, for Industrial California. My conclusions are that we have particularly in California every sound reason for industrial growth. We have a great back country. We have a great domestic market. We have the Orient, Occident, and Straits Settlements—representing two-thirds of the world's people. What else must we have? We must have raw materials. We have them. Then it is manifestly necessary that we develop our materials basic to industry; otherwise we would have no economic background for industry, and industry is the one and only institutional balance of prosperity. To this end I am willing and glad to dedicate my services.

Price to Farmer Improves

The farmer is today receiving a better price for his products than at any time in the last three years, the price index of the Department of Agriculture for the month ended May 15 reveals. On that day the index stood at 148 per cent of the pre-war level, an advance of 8 points over the April 15 level, and was the highest the index has reached since August, 1925.

An advance of 22 points has been scored since May 15, 1927, and the latest May figures is the highest for any similar month since 1920.

The seasonal decline in demand for dairy products resulted in a decline of 3 points for this department, the only loss during the period. The largest advance was in grains which jumped 16 points while cotton seed gained 12 points during the month.

Roads Improve Business in Honduras

The work done on the highways of Honduras during the past year has begun to show its effects as the dry season comes on. The new 40-mile motor road running from Tegucigalpa to Talanga (on the way to Olancho) is becoming popular and marks the first year that automobiles have ever penetrated into that section—an achievement made finally possible by the opening, on January 30, 1928, of the Hernando Lopez Bridge, the last before reaching Talanga. The automobile companies of Tegucigalpa are now running regular busses to Talanga for the sum of 5 pesos ($2.50 United States currency).

In March the first automobile reached the towns of La Villa de San Francisco and Moteceli. During the dry season cars can make their way up and down the Choluteca River Valley for a few miles from the main road, but as soon as the rains begin this traffic will be seriously impeded and it is doubtful if automobiles will then be able to go economically as far as Talanga, even on the main road.

The new route is of great assistance in transporting freight to and from Olancho, goods being hauled the first 40 miles of the trip in a few hours whereas last year it took at least two days by mule back.

Imported automobiles, which formerly came by ship to Amapala and were then lightered 20 miles by launch and unloaded on the beach by hand, are now brought from New Orleans or New York to Puerto Cortes where they are unloaded by crane directly on to railroad cars at the wharf, then shipped to Portrerillos at the rail terminus, and run from there to Tegucigalpa under their own power; the necessary crossing of Lake Yojoa on the way is made easy by a barge. This method of getting cars from the north coast saves both time and expense.

If the roads are developed to a point where they are good the year round, it is possible that a certain amount of high-value freight may enter central and southern Honduras by way of the north coast, where now all freight comes into this territory by way of the Pacific port of Amapala. Even now the opening of good roads has made it possible for automobile and tire agents of San Pedro Sula to invade the Tegucigalpa territory.

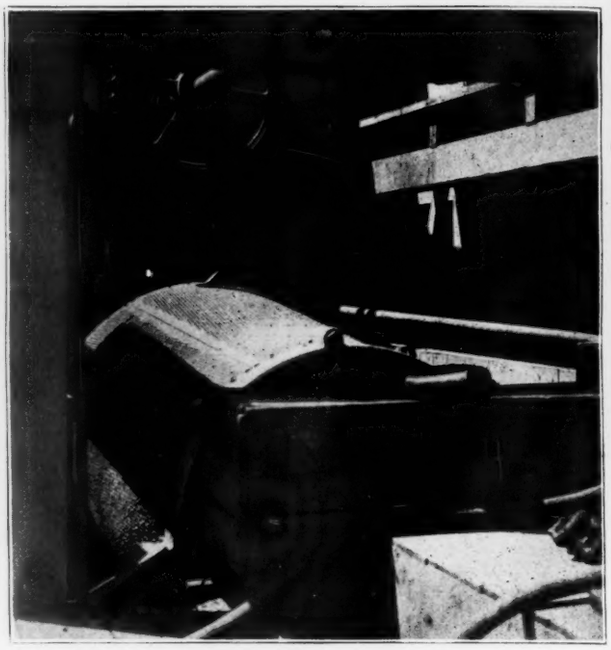
A contract has just been signed by an American automobile transportation company with the government of Honduras to establish a daily mail service between Tegucigalpa and the railroad terminus at Potrerillos. This service, to be operated every day except Sunday, will be a great advantage over the hitherto irregular and unsatisfactory mail deliveries.

SCREENING AND MATERIAL HANDLING AT BROWNELL PLANT

THE quarry and crushed stone plant of the Brownell Improvement Company at Thornton, Illinois is one of the largest and most modern in the United States. According to W. J. Black, general manager of the company, the production sometimes reaches 8,750 tons per day and in the month of May was 172,800 yards. In addition to the plant at Thornton two material yards are maintained in the Chicago district, one at 76th and Western Avenues and the other at 85th and Eggleston.

The rock after being quarried goes to an Allis Chalmers number 24 crusher, then to four Allis Chalmers number 7½ crushers and four Allis Chalmers McCully 4 inch scalping screens. The oversize goes to four number 6 Allis Chalmers crushers and joins the screenings, all of it then going to four Allis Chalmers perforated rotary screens equipped with Rolman manganese jackets. Oversize from these goes to a battery of 12 Allis Chalmers number 4 crushers and back to six more Allis Chalmers perforated rotary screens with varied sizes of openings. Screenings from there go to two Roberts and Schaefer screens, six Simplicity screens and two screens made in the plant, all of the vibratory or shaker type.

The two Roberts and Schaefer screens are the Arms double deck horizontal type, each belt driven by a Western Electric, 440 volt, 3 phase, 60 cycle, 6.4 amperes electric motor, operating at 1140 r.p.m. under full load. The screen openings are 9-16 and 1-4 inches and the slope is about 6 degrees. The

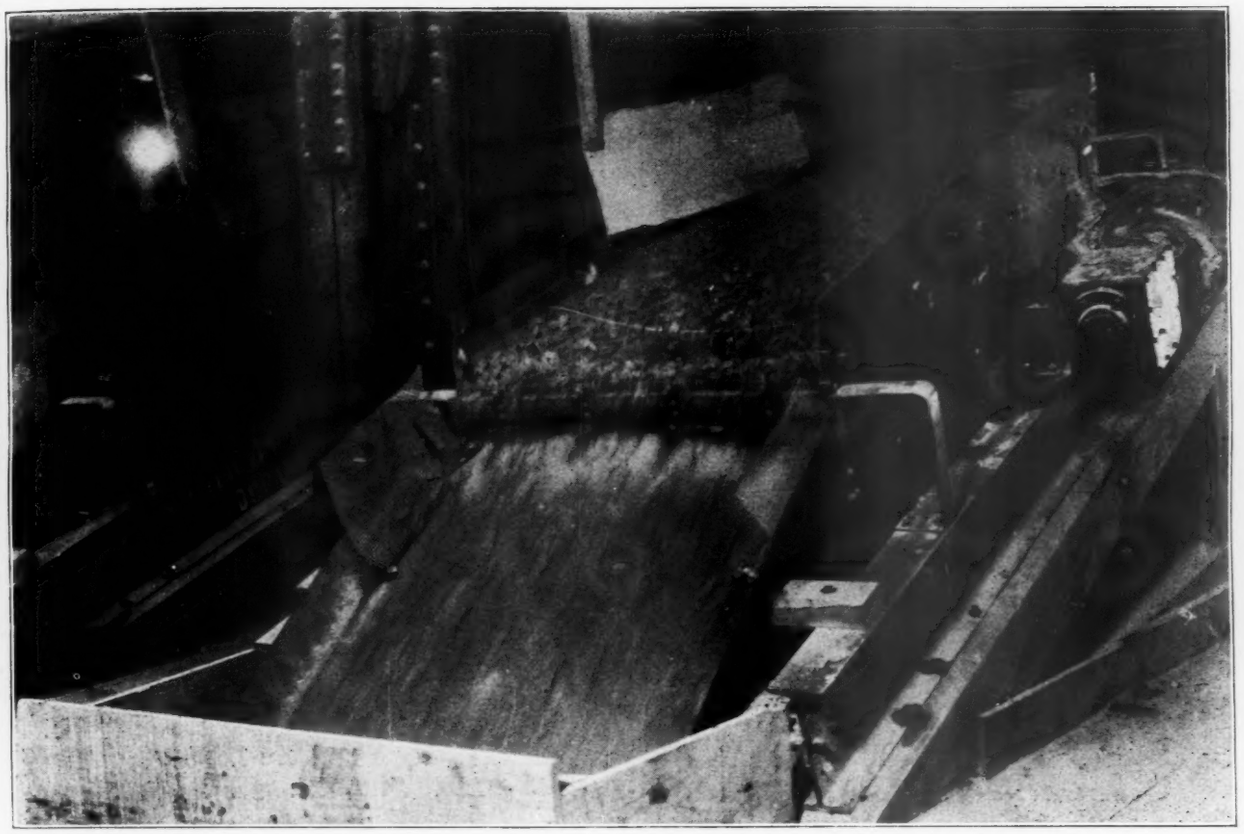


Conical Rotary Screen, Where Stone is Washed

shaking motion is imparted by opposite eccentrics with a total motion of 3-4 inches and operating at 500 r.p.m. The opposite motion neutralizes a great deal of the vibration and adds to the life of the screens.

The Simplicity single vibrating screens operate on a slope of 20 degrees and are each direct bevel gear driven by a Fairbanks Morse, 3 horse power,

View of Crushing, Washing and Screening Plant



Arms Horizontal Double Deck Screen

3 phase, 60 cycle, 440 volt electric motor operating at 1800 r.p.m. and attached directly to the base of the screen. The motion is imparted by an eccentric with a total motion of 1-4 inch, at the rate of 900 r.p.m. Four of these screens are of the double deck type and have openings of 9-16 and 1-4 inches. The other two Simplicity screens are triple deck, with openings of 9-16, 5-16 and

One of Four Sets of Double Deck Screens

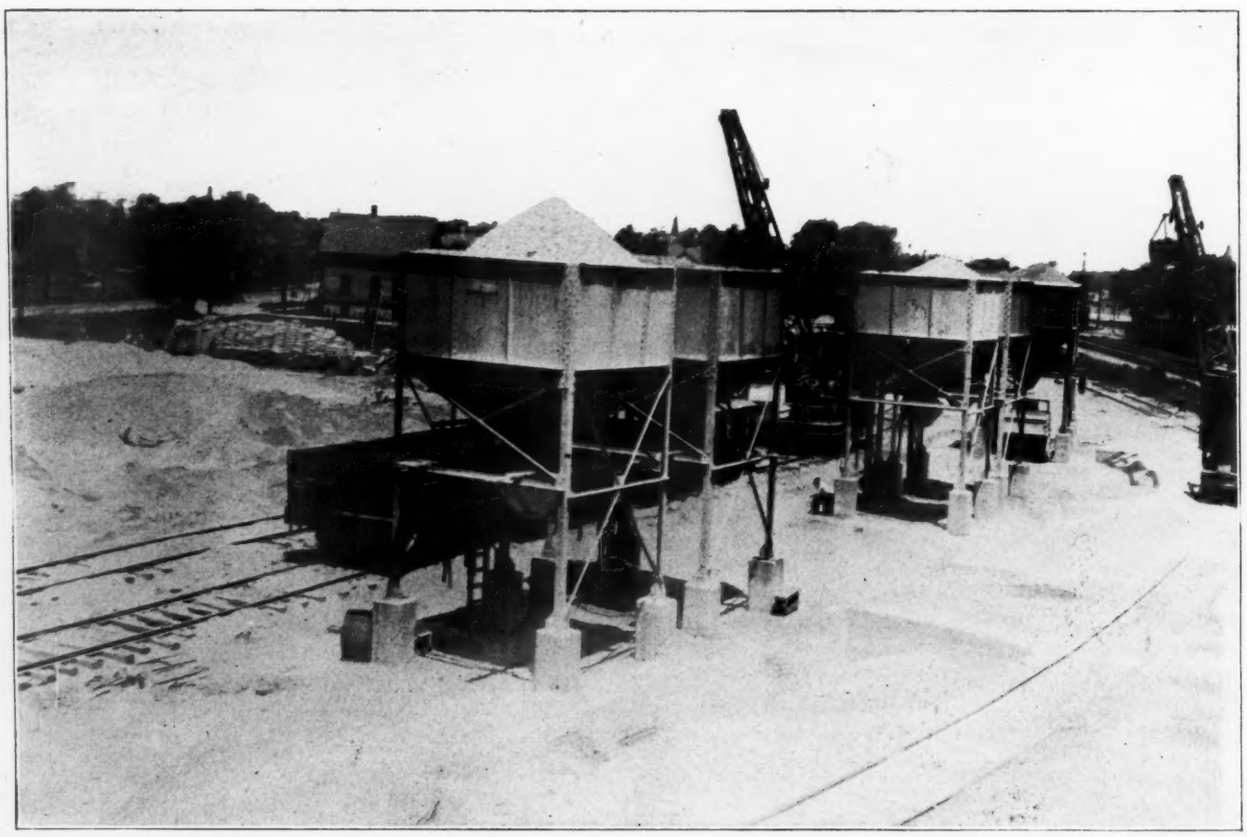
Bins and Elevators at 76th and Western Avenue

Bins and Caterpillar Crane at 95th and Eggleston Avenue

1-8 inches, the fine material passing through the latter being agricultural limestone.

Two shaking screens made in the plant are also used. These are of the double deck type equipped with 3-4 and 1-4 inch screens and operate at the rate of 200 vibrations per minute on a slope of about 3½ degrees. They are suspended from the ceiling by four rocker arms attached to the corners of the screens and are belt driven from an electric motor. The shaking motion is imparted by an eccentric with a 4 inch motion and connected to the screen, both decks working together, by a rod swiveled at both ends, giving the screen a horizontal motion only. This screen is allowed to blind as much as possible so that the coarse mate-

(*Continued on page 83*)



Bins and Storage at Thornton, Illinois

ALLIED CONSTRUCTION INDUSTRIES COMMITTEE HOLDS MEETING IN WASHINGTON

STRIVING to correct improper practices and to stabilize credit conditions in the building construction industry, representative subcontractors and general contractors have joined in the Allied Construction Industries Committee, a new body recently formed at a meeting in Washington, D. C.

Formal organization of the committee followed a series of preliminary conferences held at West Baden, Indiana; Cleveland and Chicago, under the auspices of the Associated General Contractors of America.

The organization includes members of the executive committee of the Associated General Contractors of America and two representatives of each of the trade organizations in the list of members present at the meeting. George B. Walbridge, Detroit, former president of the Associated General Contractors of America and chairman of the committee, presided at the organization meeting, and submitted a report of that session to the full conference.

Foremost among the measures to be given consideration at the Detroit meeting will be formulation of rules of ethical practices to govern relationships between owners, architects, engineers, general contractors, subcontractors, material dealers and equipment manufacturers. Establishment of a rational credit system also will be undertaken as a primary move.

The Washington meeting, held coincidentally with the sessions of the Building Division of the Associated General Contractors of America, saw broad review given to efforts already made by national associations and by local groups to rectify conditions under which sub-contractors and general contractors have for many years been forced to operate.

The joint meeting was opened in Parlor D of the Washington Hotel at ten o'clock by Geo. B. Walbridge, chairman. After a short discussion it was decided to adjourn that meeting and go into session with the Board of Directors of the Associated General Contractors of America, which was sitting at the same time for discussion of similar subjects, and then to reconvene later in the day. Accordingly the meeting adjourned and those present went to the Rose Room of the Washington Hotel, where the meeting with the A. G. C. Board was called to order at 10:25 a.m. Mr. Walbridge presided over this meeting, some of the minutes of which follow.

N. J. Biddle, manager of the Detroit Branch of the Association of Electragists, presented a large chart showing the set up of an organization plan to function both locally and nationally in matters of credit. The outstanding features of the plan presented were:

(a) Utilization of existing associations in the construction field to curtail loose credit methods.

(b) A tie in with the National Association of Credit Men.

(c) Establishment of standard credit terms suitable to each community.

(d) Policing of the credit situation through joint action.

The plan proposed by Mr. Biddle encompassed both local and national bodies but he explained that probably it would prove essential to inaugurate the system in a few cities, allowing the national feature to develop later. It was his idea that the national body would function principally as a clearing house for information and make contacts between communities for educational purposes.

Oscar Reum, president of the Contracting Plasterers International Association, at the suggestion of the chairman, addressed the meeting with a summary of conditions with respect to trade practices that have grown up in the industry.

Chas. Fanning, representing the International Cut Stone Contractors and Quarrymen's Association, expressed the thought that material dealers and producers should put in standard credit terms and adhere to them.

Clyde James, representing the United Roofing Contractors Association, expressed the thought that it was not advisable at this time to attempt to go into all of the relationships between general and sub-contractors.

Henry Ericsson, a vice-president of the Associated General Contractors, expressed strong favor for establishment in the various cities of a sound credit system to curtail the looseness which exists.

James E. Vaughn, Jr., representing the National Association of Credit Men, gave a very clear presentation of credit conditions in construction and advised that material men were beginning to organize for the establishment of proper credit.

The afternoon session was called to order at 2:10 o'clock. A motion was introduced, seconded and passed, as follows:

"Moved that the Joint Committee of the General and Sub-Contractors be requested to take up immediately the question of developing a proper credit system applying to all of the trades."

J. J. McClymont, representing the National Association of Marble Dealers, expressed a hope that the time would come when cash discounts in construction would be established down the line from owner to the last man.

Edward McDonnell, representing the Contracting Plasterers International Association, offered a motion which was finally amended and passed as follows:

"Moved that the joint committee be requested to continue its present activities and that this motion be taken as a vote of confidence."

Upon motion to adjourn, the meeting was closed and Mr. Walbridge then called a meeting of the joint committee.

Minutes of the Joint Committee

The committee discussed in detail the question of publicity as it was recognized that considerable educational work must be done in all of the industries with respect to credit and trade practices and the secretary was requested to notify all of the trades that the committee would be a permanent organization with authority from all of the organizations to formulate plans and proceed with its work.

After considerable discussion of the question, it was decided to call the joint committee the Allied Construction Industries Committee. The secretary was instructed to urge all the trades to designate their representatives as soon as possible, so that their names might be placed on the letterhead. It was decided that the next meeting should be called in Detroit about ten days after the work of compiling the codes had been completed.

The meeting adjourned about six o'clock.

The board passed the following Resolution:

WHEREAS: The construction industry has become seriously demoralized through loose credits and over-expansion in its various branches, and,

WHEREAS: this condition has generated trade practices which are injurious to the building public and the related industries of construction, and,

WHEREAS: these industries, through the Allied Construction Industries Committee, are seeking to correct improper practices and stabilize credit conditions.

THEREFORE, BE IT RESOLVED that the Executive Board of the Associated General Contractors of America endorses the work of this national committee and commends its activities to local units of the industry.

List of Attendance

Association of Electragists—N. J. Biddle, Mgr., Detroit Branch, A. of E.; E. C. Gramm, Washington, D. C.; L. T. Soudor.

Heating and Piping Contractors National Association—Henry B. Gombers, Secy., New York City.

International Cut Stone Contractors and Quarrymen's Association—Chas. G. Fanning, Chicago; James Steven, Jr., The Steven & Son Company.

National Association of Marble Dealers—J. J. McClymont, McClymont Marble Company, Milwaukee, Wis.

Contracting Plasterers International Association—Oscar A. Reum, Chicago; Edward McDonnel, secretary-treasurer, Detroit.

National Association of Sheet Metal Contractors—J. A. Pierpoint, Washington, D. C.

Elevator Manufacturers Association—John W. Ogron, Commissioner, E. M. A., Chicago; C. G. Holland, Westbrook Elevator Mfg. Co., Danville, Va.; Frank Mechling, Atlantic Elevator Co., Philadelphia.

United Roofing Contractors Association—Geo. E. Moore, Chicago; Clyde C. James, Grand Rapids, Michigan.

The Tile and Mantel Contractors Association of America—H. R. Cole, Secy., Wilmington, Delaware; Clarence W. McCaulley, Pres., Wilmington, Delaware.

National Association of Building Trades Employers—E. M. Craig, Secy., Builders Building, Chicago.

National Association of Credit Men—James E. Vaughn, Jr., Chicago.

National Surety Company—Wm. B. Joyce, N. Y. C.; E. A. St. John, N. Y. C.

American Contractor—R. D. Winstead, Editor, Chicago.

Hollow Metal Association—C. F. Burt, Secy., Cleveland, Ohio.

Insulite Company—Wm. M. Temple, Washington, D. C.

Paint and Varnish Manufacturers—D. L. Thomson, Washington, D. C.

Kalman Steel Company—L. C. Helgesen, New York City.

Otis Elevator Company—R. H. A. Carter, Washington, D. C.

Engineering News Record—C. S. Hill, New York City.

U. S. Interdepartmental Board of Contracts and Adjustments—Major E. W. Cushing, Washington, D. C.

National Association of Builders Exchange—Earl Stokes, Washington, D. C.

Beverages Taxed to Build Roads

A law which has just been approved by the Latvian Cabinet of Ministers provides for the imposition of a 3 per cent tax on all alcoholic beverages, to raise revenues for the road funds under the Ministry of Communications, according to Trade Commissioner Lee C. Morse, Riga, in a report to the Department of Commerce. For the imposition of this tax, the Tax Department shall fix average retail prices which are subject to the approval of the Ministry of Finance. The tax shall be collected simultaneously with the excise tax, and the whole revenue from the tax will go to the road fund.

Largest Construction Record in May

The highest month ever recorded for construction started in the 37 states east of the Rocky Mountains is the report of F. W. Dodge Corporation. New building and engineering work contracted for in these states (about 91 per cent of the total country) during the past month amounted to $668,097,200. This tops the previous high record of April 1928 by about 25 million dollars. The increase over May of last year was 21 per cent.

The combined total for new construction started during the first five months of this year is also a record breaking figure. The total for the first five months of 1926 held the record up until now. This year's figure, amounting to $2,796,301,300 is 9 per cent ahead of the total for the first five months of last year and is 7 per cent over the total for the corresponding period of 1926.

Analysis of last month's contract total showed the following important classes of work: $288,825,800, or 43 per cent of all construction for residential buildings; $150,223,200, or 22 per cent, for public works and utilities; $91,200,200, or 14 per cent, for commercial buildings; and $47,851,000, or 7 per cent, for educational projects. New work planned in the 37 Eastern States during the past month amounted to $882,244,700. This figure is 4 per cent ahead of the amount reported in the same month of last year and is 6 per cent over the amount reported in the preceding month of this year.

New York State and Northern New Jersey

New York State and Northern New Jersey had $184,555,100 in contracts for new building and engineering work during the past month. The above figure was the largest May ever recorded for this district and it was also the highest monthly total on record since December 1926. Last month's total showed a 22 per cent gain over the total for the preceding month and it was also 33 per cent ahead of the May 1927 record.

The following were the most important classes of work in the May construction record: $95,607,100, or 52 per cent of the total, for residential buildings; $32,840,000, or 18 per cent, for public works and utilities; $25,053,300, or 14 per cent, for commercial buildings; and $7,487,200, or 4 per cent, for industrial projects.

During the past five months there was $757,805,600 worth of new construction work started in New York State and Northern New Jersey, being an increase of 12 per cent over the amount started during the first five months of last year. New work planned in this district during the month of May reached a total of $267,170,800. There was an increase of 28 per cent over the amount reported in the same month of last year and a gain of 3 per cent over the amount reported in April 1928.

New England States

New building and engineering work contracted for in the New England States during the month of May amounted to $60,229,800. This figure was the largest monthly total ever recorded in this territory. There was an increase of 30 per cent over the total for April of this year and a gain of 45 per cent over the total for May of last year.

Included in the month's record were the following outstanding items: $21,170,600, or 35 per cent of all construction, for residential buildings; $16,180,400, or 27 per cent, for public works and utilities; $8,641,600, or 14 per cent, for commercial buildings; and $7,134,400, or 12 per cent, for educational projects.

Last month's contract total brought the amount of new construction started in these states since the first of the year up to $207,887,100, being 23 per cent in excess of the total for the corresponding period of last year. Contemplated projects as reported in the New England states during the past month amounted to $48,089,000. This amount was 53 per cent ahead of the May 1927 record, but showed a loss of 5 per cent from the total for April of this year.

Middle Atlantic States

During the past month there were $76,937,300 worth of contracts awarded on new building and engineering work in the Middle Atlantic States (Eastern Pennsylvania, Southern New Jersey, Maryland, Delaware, District of Columbia and Virginia). The above figure was the largest May contract total on record for this district. It was 38 per cent ahead of the total for May of last year, but was 25 per cent under the total for April of this year.

Analysis of last month's construction total showed the following important classes: $34,436,500, or 45 per cent of all construction, for residential buildings; $12,987,900, or 17 per cent, for public works and utilities; $9,789,000, or 13 per cent, for educational projects; and $8,957,600, or 12 per cent, for commercial buildings.

New construction started in these states since the first of the year has reached a total of $347,452,800, being 14 per cent ahead of the total for the corresponding period of 1927. New work planned in the Middle Atlantic States during the past month amounted to $137,599,600. There was an increase of 27 per cent over the preceding month, but a loss of 5 per cent from the total for May of last year.

Pittsburgh District

New construction work started in the Pittsburgh District (Western Pennsylvania, West Virginia, Ohio and Kentucky) during May amounted to

$67,469,300. This figure was 10 per cent less than the total for the preceding month and was 14 per cent under the total for May 1927. Last month's record included: $29,173,300, or 43 per cent of all construction, for residential buildings; $19,787,500, or 29 per cent, for public works and utilities; $7,027,800, or 10 per cent, for educational projects; and $3,669,700, or 5 per cent, for commercial buildings.

During the past five months there were $288,409,200 worth of contracts awarded on new building and engineering work in this district, which was a drop of 13 per cent from the total for the first five months of last year. New work contemplated during May in the Pittsburgh District reached a total of $80,887,800. This figure was just a little ahead of the total ($80,364,900) for April of this year, but there was a loss of 13 per cent from the total for May of last year.

Central West

The highest May on record was reached last month in the Central West (Illinois, Indiana, Iowa, Wisconsin, Southern Michigan, Missouri, Kansas, Oklahoma and Nebraska.) The total, $192,868,300, was 27 per cent in excess of the amount reported in the same month of last year and was 3 per cent ahead of the amount reported in April of this year. Last month's contract total included the following important classes of work: $79,074,900, or 41 per cent of all construction, for residential buildings; $48,296,600, or 25 per cent, for public works and utilities; $35,510,000, or 18 per cent, for commercial buildings; and $11,342,100, or 6 per cent, for educational projects.

New construction started in the Central West during the past five months has reached a total of $823,084,300, as compared with a total of $680,583,700 for the first five months of last year, the increase being 21 per cent. Contemplated new work as reported in this district in May amounted to $225,670,500. This was just a little ahead of the amount ($217,337,500) reported in the preceding month, but there was a loss of 15 per cent from the amount reported in May of last year.

Northwest

The volume of construction started in Minnesota, the Dakotas and Northern Michigan during the past month amounted to $9,483,700. This figure was 33 per cent ahead of the total for April of this year and there was a 10 per cent gain over the total for May of last year. Included in last month's contract total were: $3,114,800, or 33 per cent, for public works and utilities; $2,672,600, or 28 per cent, for residential buildings; $912,800, or 10 per cent, for social and recreational projects; and $872,000 or 9 per cent, for educational projects.

During the past five months there was $27,428,600 worth of new construction started in the Northwest, which was a drop of 19 per cent from the amount started in the corresponding period of last year. New work contemplated in this territory in May reached a total of $11,830,300. This figure was less than 1 per cent under the amount ($11,874,200) reported in the preceding month and there was a gain of 7 per cent over the amount reported in May 1927.

Southeastern States

Construction started in May in the Southeastern States (the Carolinas, Georgia, Florida, Tennessee, Alabama, Mississippi, Arkansas and Louisiana) reached a total of $49,851,300. This figure was 10 per cent less than the total for the same month of last year and there was a drop of 10 per cent from the total for the preceding month of this year. Analysis of last month's record showed the following items of note: $18,156,500, or 36 per cent of all construction, for residential buildings; $11,531,100, or 23 per cent, for public works and utilities; $7,367,400, or 15 per cent, for industrial projects; $4,582,000, or 9 per cent, for commercial buildings; and $4,478,800, or 9 per cent, for educational projects.

New building and engineering work contracted for since the first of this year in this district amounted to $241,254,700, as compared with $262,520,000 for the corresponding period of last year, the decrease being 8 per cent. Contemplated projects as reported last month in the Southeastern States reached a total of $76,347,700. There was a 40 per cent gain over the total for May of last year, but a drop of 5 per cent from the total for April of this year.

Texas

Texas had $26,702,400 in contracts for new building and engineering work during the past month. The above figure was the second largest May contract total on record for this state. It was 24 per cent ahead of May of last year and was 43 per cent over the total for April of this year. The following were the outstanding classes of work in the May construction record: $8,534,300, or 32 per cent of the total for residential construction; $5,518,700, or 21 per cent, for industrial projects; $5,484,900, or 21 per cent, for public works and utilities; and $4,038,600, or 15 per cent, for commercial buildings.

New construction started in Texas during the first five months of this year amounted to $102,979,000, being an increase of 9 per cent over the amount started in the first five months of last year. New work planned in this state during the month of May reached a total of $34,649,000. There was an increase of 51 per cent over the amount reported in April of this year and an increase of 15 per cent over the amount reported in May 1927.

NEW OHIO SAND AND GRAVEL PLANT EXAMPLE OF EFFICIENCY

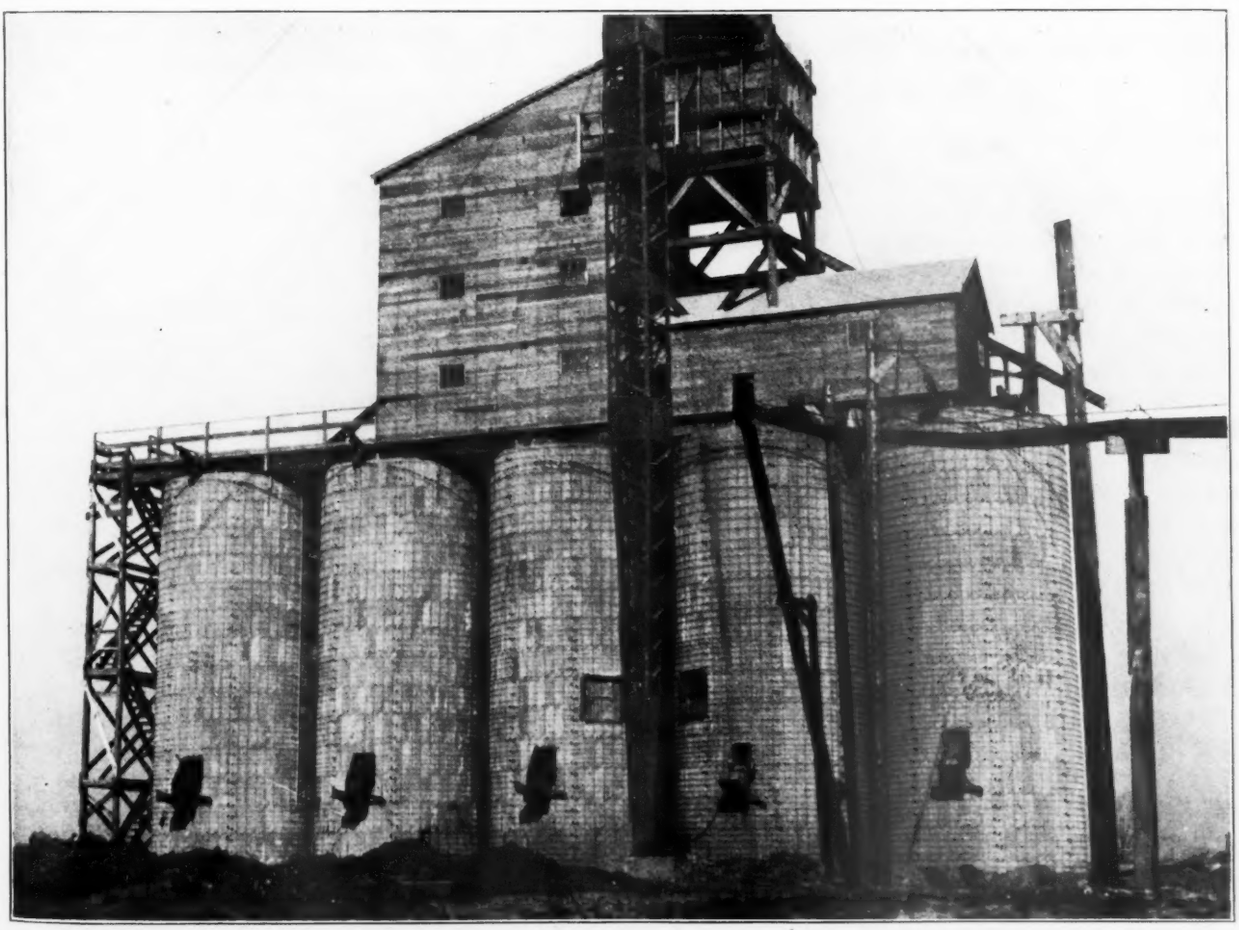
SIMPLICITY is frequently found in the sand and gravel plants in the United States but it does not exist probably any more completely than in the case of the new sand and gravel plant at Chillicothe, Ohio of the Chillicothe Sand and Gravel Company. This new plant is an excellent example of simplicity.

An Insley shovel equipped with a 1½ yard bucket is used for stripping the overburden. A 1½ yard Pioneer aerial cableway is used to excavate and elevate the material to the screening and washing plant. At the present time the distance from the digging area to the plant averages about 500 feet. American Steel and Wire Company rope is used in the cableway. A Thomas two drum hoist operates the cableway. The mast is 93 feet high.

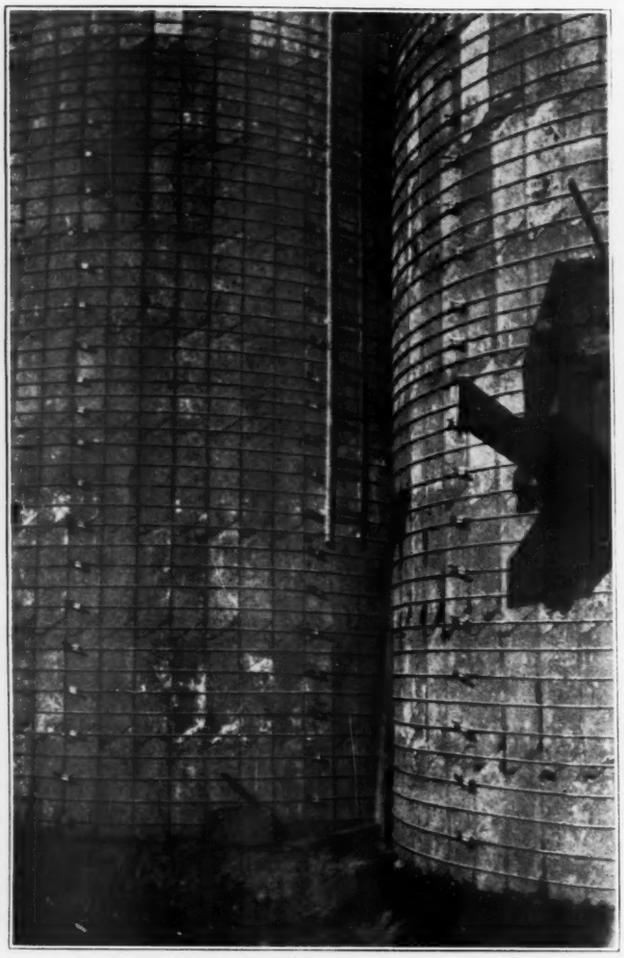
The material is dropped into hoppers at the top of the plant. A hydraulic nozzle plays on the material in the hopper and gives the preliminary scrubbing action. This method is quite clever. The water also carries the material down to the screens. Five sizes are produced and all screening is handled by Niagara vibrating screens. There are two of these screens. One is a triple deck and the other a double deck.

The Plant Office

The material passes from the screens direct to five storage bins. These bins were manufactured by the Neff and Fry Company. These are con-



Screening and Storage Plant



Close-up of Chillicothe Bins

crete gravity storage bins and are equipped with Neff and Fry gravity loading gates. These bins are simple in construction and can be added to or taken down and moved to another location. The chutes to the bins are made of Toncan steel sheets manufactured by the Central Alloy Steel Company.

Only three men are required to operate. Electric power is used and this is purchased. Shipments are made by both truck and railroad.

(Continued from page 41)

months in continuing the Slag Association Associateship work on "Durability" at the Bureau of Standards since the completion of one division of the original program. Within the next few months, unless the Problems Committee enlarge their activities, I would suggest that plans be formulated to resume the work at that laboratory.

Something over two years ago I outlined a suggested plan of associated research to be shared on a five year basis with the producers of other mineral aggregates and stated as my belief that we could get more results from our combined finances and the use of equipment already installed in laboratories that would welcome such work, than we could in any other way. With talent already at hand in those institutions, with libraries and sources of information available at all times, there was the thought that not only testing and investigational programs could be accomplished on a larger scale, but it would be impossible to waste money in duplication of effort as would invariably occur in isolated and individual bits of work.

At this time I'm reporting complete failure. Trade magazines interested in "Mineral Aggregates" and the "Bulletins" of the opposing camps, are detailing the individual plans of these organizations to get into the testing and research field immediately.

According to these articles, talent is being secured to supplement that already within the groups, equipment is being scrutinized and purchased, laboratory space is being leased, and there is seemingly something to a recent magazine editorial regarding "The Battle of the Aggregates."

As yet adequate weapons have not come forth from these factories for practical warfare (for either defense or offense). At the present time they, The Big Brothers, are using data borrowed mostly from another laboratory and taking turns walloping each other with the figures.

Remember though that I'm not laughing at the spectacle, I'm very seriously watching the outcome.

Reduced to the simplest possible terms if it ever is determined that, granted you desire certain qualities in a road slab you will have to place one-half inch more concrete made with one aggregate than you would if you used another, then the first aggregate is most certainly carrying an awful load per mile of construction.

Somehow I mentally picture the variation in the height of cylinders drilled from three miles of concrete highway construction designed for seven inch thickness that I saw probably two years ago. There were thirty-five or forty cylinders and their height ranged from four and one-half to eight and one-half inches—you know in the face of that sort of evidence it looks to me as though the boys were sort of playing with frozen cobwebs.

Probably, however, that degree of refinement in many details touching our industry will come some time just as we are accomplishing things today as a matter of routine that only a few years ago we thought were impossible.

But I'm firmly convinced that after whole reams and books and libraries have been turned out on this sort of thing that for many years to come "Availability" of aggregate will determine its choice, and that likewise a tremendous volume of concrete will be "Poured" on a basis of "1:2:4" and likewise "1:3:6."

At this time I would like to thank you all for the support that you have given the work of the Association and I would like to thank the officers for their assistance in many situations which required that I call on them to consider with me. The Problems Committee has functioned faithfully and well, they also deserve your thanks.

(*Continued from page 76*)

rial will go to six Stephens Adamson, Gilbert type, conical rotary screens outside of the plant where the stone is screened and washed.

The stone then goes to the storage bins from which it can be loaded into railway cars for direct shipment to the consumer or one of the Chicago yards, or into 30 yard standard gauge Western dump cars which haul it to a material yard adjoining the plant where it is dumped into three pits, each 34 feet long, 8 feet wide and 8 feet deep. Link Belt 1½ cubic yard locomotive cranes lift the stone from the pits into seven Seaverns steel bins equipped with batch hoppers. Excess material is piled in stockpiles to take care of emergencies.

Material Yards

Stone is shipped directly from the plant to the company's material yard at 95th and Eggleston Avenues over the Chicago and Eastern Illinois railway, and to the yard at 76th and Western Avenues over the Baltimore and Ohio railway. T. B. Gist is superintendent of both of these plants.

At the 76th street yard, which was built early this year, the stone is dumped from the "high hoppers" into two hoppers in a 10 foot pit under the tracks. A Clyde one drum hoist is used to pull the cars into position over the hoppers and is equipped with a Lincoln 15 horse power 220 volt electric motor and a Cutler Hammer controller. The hoppers dump onto two flight conveyors, each driven by a 5 horse power Allis Chalmers electric motor, which converge and dump into another hopper in a 15 foot pit. This hopper dumps into an elevating conveyor driven by an Allis Chalmers 30 horse power slip-ring electric motor. The elevator operates on 75 foot centers and is made up of 200 one cubic foot buckets. A spout, into which the elevator dumps, can be directed from the ground so as to unload into any of the 5 bins.

The entire plant was designed by the James B. Seaverns Company and all of the hoppers and conveying machinery except the motors were furnished by them, including the center bin which is of steel plate construction.

Car Puller and Elevator at 76th and Western

Tractor Stockpile Loader Filling an Emergency

The concrete work, which includes a reinforced floating foundation under the bins, the walls and floors of the pits, and the four concrete bins, was done by the Miller and Weaver Company. Each of these bins as well as the steel bin has a 300 cubic yard capacity.

While not produced by the company, sand is also handled both in the bins and stock piles. A Barber Greene tractor type stock pile loader is used to handle excess material and recently came in very handy when a delay in the delivery of several carloads of sand made it necessary to load from the stockpile.

The 95th street yard, which was built in 1925, receives its material direct from the plant in gondolas from which it is loaded into ten Seaverns steel bins of 40 cubic yard capacity or into the stockpiles by three Pawling and Harnischfeger ¾ yard caterpillar cranes.

Trade Associations Helpful

Trade associations were described as effective stabilizing agencies in business in an address last month by Abram F. Myers, member of the Federal Trade Commission, before the Interstate Cotton Seed Crushers Association at New Orleans. Industries possessing strong trade associations, said Commissioner Myers, are "equipped with self-regulation in a degree which, if wisely directed, will effectively preclude governmental interference by rendering it unnecessary."

Employment Improving

While industrial employment throughout the United States continues substantially below the levels of a year ago, the seasonal decline during May was considerably smaller than during the corresponding periods of the preceding four years according to the monthly report of the bureau of labor statistics of the U. S. Department of Labor.

Compared with April of this year, employment totals declined 0.2 per cent, but pay roll totals gained 0.2 per cent. There were, however, 4.7 per cent fewer workers on factory pay rolls last month than a year ago and pay roll totals were 5.8 per cent smaller.

MANUFACTURE AND USE OF SLAG PRODUCTS

THIS article is an abstract of Symposium number 4 of a series published by The National Slag Association of Cleveland, Ohio, and is devoted entirely to the manufacture and use of slag products.

Manufacture of slag products of various kinds opens a large field to the slag producer as well as to the products manufacturer. It is in the nature of a conservation of natural resources, and results in a line of products which is finding an ever-increasing market throughout the country, based on the successful use of such materials in every type of building construction.

The symposium includes not only those products made from portland cement concrete, but other combinations of materials, treated under the following headings:

1. Concrete products, made with portland cement as the cementing agent.
2. Slag-lime products, with hydrated lime as the cementing agent.
3. All-slag products:

(a) In which granulated slag is used as the cementing agent.

(b) In which the product is cut from the solid slag after cooling.

(c) In which the product is cast from molten slag and annealed.

Slag Concrete Products

The usual concrete product need not of necessity have a high resistance to abrasion or have a high transverse strength, but there are other characteristics that make the choice of aggregate highly important. In concrete building units which are likely to be subjected to high temperatures, the choice of aggregate may mean the difference between a fire-resisting product and one which will crumble under fire. In this respect, slag concrete building units are second to none.

The lighter weight of the slag concrete unit recommends itself to masons, and the added toughness is of decided advantage since it cuts down breakage due to handling.

The U. S. Bureau of Standards has issued a Circular, number 304, "Properties and Manufacture of Concrete Building Units", in an effort to bring out the essential factors concerning concrete block, brick, and building tile. Slag is listed by the authors, Frank A. Hitchcock, engineer, and John R. Dwyer, associate engineer, of the cement section, as a suitable aggregate.

Concrete block is defined by the authors as follows:

"A precast regular unit of which 60 per cent or more of the cross-sectional area, as laid in the wall, is of concrete material. There are three general types in use—solid blocks; hollow blocks having one, two or three air cells; and two-piece blocks which are held together in the wall by mechanical means, thus affording an air space and furnishing any desired wall thickness. At the present time there are some 12 varieties of blocks which vary in height from 1¾ to 11¾ inches, in width from 1¾ to 24 inches, and in length from 15⅝ to 31¾ inches. With the cooperation of interested societies and manufacturers, the Division of Simplified Practice of the U. S. Department of Commerce is recommending one uniform height of 7⅝ inches, a length of 15⅝ inches, and widths of 6, 8 and 12 inches."

Slag is also included as one of the fine aggregates in this circular, which covers thoroughly the problems of materials, proportioning, mixing, molding and curing.

"There are two classifications of mixers, according to continuity of operation—namely, batch type and continuous type.

"From the standpoint of molding processes, block machines would be divided into three main types—dry tamp, pressure and pour. The dry-tamp machine is probably the most widely used. The essential principle is the use of rammers to compact into a mold a mix of such dry nature that the freshly-formed block can be immediately removed from the mold without breaking or serious deformation.

"The pressure type of machine effects the compacting of the mortar or concrete by pressure applied by hydraulic means or by power or hand through a system of levers or toggle joints.

"In the pour process, a wet mix is poured into molds and the concrete is worked into place by tamping, vibrating, or jigging. In some cases the jigging is accomplished by means of deformed wheels on the mold cars during the movement of the cars. This pouring method requires the retention of the concrete in the molds until sufficiently hardened to permit handling."

A large number of instances of slag being used in the making of concrete blocks and of statements made in various magazines by authorities in the field are included in the symposium, several of which follow.

Dr. Passow of Hamburg, Germany, in an article "Blast Furnace Lump Slag as Concrete Aggregate," published in the May 10 number of the "Stahl und Eisen" magazine says:

"In the course of time, I have tested a large number of concrete samples, and in this way received many concrete blocks which had to be rejected. But among these poorly-hardened blocks I did not find one made of lump slag. On the contrary, the concrete made of lump slag proved itself, without exception, free from objections."

The Underwriter's Laboratory of Chicago, in cooperation with the Portland Cement Association,

the Concrete Products Association, and the American Concrete Institute, conducted a comprehensive fire test on concrete building units, including two types of block and one of tile.

Specimens were manufactured under the direct supervision of E. W. Dienhart of the Portland Cement Association, M. J. O'Brien of the Underwriter's Laboratories, and Stanton Walker of Lewis Institute, Chicago.

All of the units tested were hollow, one block having two air spaces and the other three. To the latter class belonged those blocks which were tested for the effect of aggregate on fire resistance—slag, limestone, pebbles and cinders being the aggregates considered. The concrete was made in a continuous mixer, and the blocks were power-tamped and steam-cured. The mix used was 1:5 and the size of the blocks 8 by 8 by 16 inches. After being subjected to the Standard Fire Test, the conclusion was reached that—

"One-piece hollow concrete building units of crushed limestone, of crushed slag, of crushed cinders, or of sand and calcareous pebbles are capable of withstanding standard fire exposure conditions (when set up in a wall) in excess of 5 hours without serious bulging and without spalling or dislodgement and without permitting the passage of flame, radiant heat or smoke through the wall or partition assembly."

Concrete brick is made up as both common and face brick and uses the smaller sizes of slag. Some very pleasing effects are obtained with coloring materials, giving the appearance of the best clay face brick.

The Bureau of Standards Circular number 304, previously quoted, defines a concrete brick as follows:

"A concrete brick is a solid concrete building unit usually rectangular in shape, of the following approximate dimensions: Height 2¼ inches, width 3¾ inches, and length 8 inches."

C. E. Ireland, vice president of the Birmingham Slag Company, of Birmingham, Alabama, says:

"Because of the cementing qualities of the slag, a much leaner mix can be used than in the production of concrete brick using sand as the aggregate. It has been found that a 1:7 mix by volume is sufficient to give compressive strength of 2000 pounds per square inch. Even a leaner mix than this can be used if there is ample space available to allow the brick to cure for a greater length of time. The finished product is a brick of unusual strength which increases with age, and bonds with the mortar, producing a semi-monolithic wall, and is used in every type of building construction.

"Concrete brick are just as hard and waterproof as clay or shale brick. They bond readily with the mortar and will not break away from the mortar in the wall because of contraction and expansion. This is due to the fact that mortar and concrete brick are composed of ingredients so nearly alike that the coefficient of expansion and contraction is practically the same. Because of the fact that they are not burned, no deformities occur from uneven distribution of heat, as is the case with clay or shale brick."

Other citations from various sources, on the making and curing of concrete brick, and tests made of them, are included in the symposium.

Concrete pipe for electrical conduits is becoming more widely used, as its superiority over other materials has been proved in a number of instances. The concrete effectively resists the passage of electric arcs, and its fireproof qualities are of value in case of a cable burnout. A number of instances in which concrete conduits using slag aggregate are used are included, from both this and foreign countries.

The symposium goes on to describe the manufacture and use of slag as an aggregate in the manufacture of such concrete products as: Copings, curbs, facing for concrete block, concrete flagging, floor and ceiling units, gates for level crossings, girders, house units, landings, lintels, lumber, manholes, mantels, monuments, pegs, pit props, posts, platforms for railway stations, sills, slabs, stairs, stoves, stones, ties, tile, trimstone and artificial stone, vaults, precast walls, piles, and pipe.

Among the many instances cited concerning these products is the construction by Colonel Rabut, a French civil engineer, of slag concrete piles 65 feet long and 15¾ inches square in connection with a large jettty built in the Arsenal of Larient, and the construction of tank wagons and barges of the same material. A description of this appeared in the August 15, 1922 number of the "Canadian Engineer" magazine.

A. N. Spice, vice president of the Duquesne Slag Products Company, of Pittsburgh, Pennsylvania, describes four methods of manufacturing concrete pipe and mentions another, as follows:

(1) The oldest method—the pouring process—uses a wet mixture, which is poured into the molds; spading or rodding in the molds will allow the use of less water, with this system, and give a compressive strength of 2,000 to 2,400 pounds per square inch.

(2) The jarring process, in which the concrete is placed in forms which are raised and dropped, thus jolting or jarring the concrete into compactness. This permits a reduction in water content, with a compressive strength of 2600 to 3000 pounds per square inch.

(3) The tamping method, in which the concrete is fed into forms on a revolving table, the concrete being tamped continuously by the tamper iron, which is a patented, specially built machine. It allows the use of a dry concrete, with a compressive strength to 4200 to 5000 pounds per square inch, and the pipe can be removed from the mold immediately after tamping.

(4) The packer-head machine, in which the concrete is fed into an external form while continuously shaped and compressed by an interior revolving head, which compacts it. For this method the concrete is made somewhat dryer than for the tamping process and the pipe is also removed as soon as the mold is completely filled.

(5) The centrifugal method, in which the concrete is formed into pipe by centrifugal force.

Mr. Spice, in further discussing the use of slag aggregate in pipe, says that properly made slag aggregate concrete pipe will stand breaking tests, absorption tests, and percolation tests as well as parallel concrete in which other recognized materials are used as the mineral aggregate.

The use of products depending on hydrated lime for binder has been more extensive in Europe than in America. Both the English and the Germans have experimented thoroughly with such products, preferring to use lime rather than the more expensive portland cement. The slag-lime product, of course, is just one step further from the manufacture of slag cement, which is an intimate mechanical mixture of granulated slag and hydrated lime. With the addition of a small amount of water and a little more granulated slag for aggregate, the result is a slag-lime brick, block, etc. Naturally, the manufacturer of slag cement drifted into the slag-lime product industry, since he had all the necessary materials at hand. Therefore, since slag cement is more widely used in Europe, than in America, the former also provides a larger market for slag-lime brick, block and various other products.

A number of quotations from articles and instances are quoted in the symposium on the mix, manufacture and use of slag-lime bricks and blocks, as well as copings, garden edging, lintels, pipe, sills, sinks, stone and tile.

Cast Slag Products

Numerous more or less successful attempts have been made to utilize blast furnace slag as it comes molten from the furnace, by casting it into molds and annealing it into a dense tough material. Most of these processes have been carried out in Europe, but there is at least one American iron and steel works working on the problem at the present time. If this casting could be accomplished economically, producing a uniform product, many uses would be found for it, as it is very tough, dense, and durable.

Products, discussed in the symposium, made of cast slag are: Block, brick, stone, building units, cannon-balls, curbstones, and ornamental products.

All-Slag Products

There have been slag products manufactured and used which do not come under the heading of concrete products, slag-lime products, or cast-slag products. Paving bricks and other articles have been cut from solid lumps of ordinary slag. In a previous paragraph of the symposium, Dr. Guttman told of cutting sculptural work from specially treated slag, and so on. The remaining section, therefore, covers only those products which are of an all-slag nature, and do not come under any of the previous classifications.

Dr. Guttman, of Dusseldorf, Germany, in order to make ordinary slag available for sculptural purposes, put the liquid slag through a processing similar to that of glass, and removed the pores from the cooled product.

Other products discussed under this heading are hewn slag stones and pressed slag bricks, slabs, and tile. About the latter it may be said that it is sometimes possible, with a basic slag, to produce a fair grade of brick, with the addition of water only. This takes advantage of the hydraulic qualities of certain slags, but is not capable of general application.

Slag swimstone is also manufactured in Germany, and is an all-slag product, closely resembling the Rhenish swimstone, which it replaces in building construction, in its extremely light weight.

The magazine "Iron Age", in its annual review for 1923, made the following distribution of the uses of air-cooled slag in the United States.

"Seven million tons is divided as follows—45 per cent goes to roads and city paving other than concrete; 25 per cent to railroad ballast; 25 per cent to aggregate in concrete; 1 per cent to roofing; and 4 per cent for miscellaneous applications, such as slag brick, concrete blocks, etc."

The only conclusion that could be reached from the foregoing accumulation of data is the obvious one—that slag has been used in nearly every type of product imaginable—slag-concrete, slag-lime. poured slag, pressed slag and cut slag—and with great success. In the United States, those products made of slag concrete are the only ones increasing in use, the other forms being more common in Europe. Wallace R. Harris, in his book "Concrete Products, Their Manufacture and Use" says:

"Air-cooled blast furnace slag has proven its value in concrete work of all kinds such as buildings, bridges, highways, sidewalks and concrete products. Having a high fusing point, slag concrete is particularly adapted for use where high temperatures are likely to prevail either by intent or accident.

"Tests made on slag concrete cylinders and cubes show that this material is worthy of the careful consideration of every products plant operator. Crushed blast furnace slag has been used successfully in the construction of modern concrete highways, bridges, sewers, culverts and buildings. Its use is increasing in the concrete products industry. Building block, hollow building tile and burial vaults are only a few of the products now being made of slag aggregate where slag is available."

PIT AND QUARRY FOREIGN DIGEST

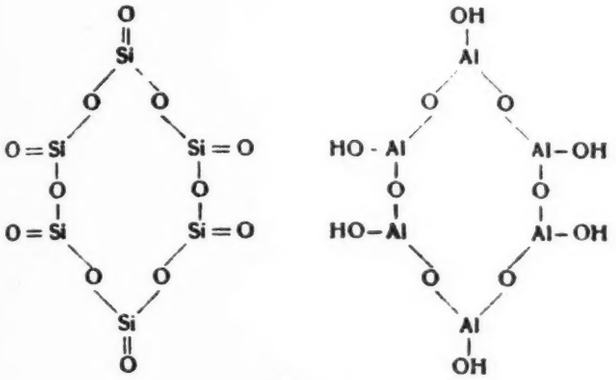


Figure 1

Constitution of Cement

According to W. and D. Arch, the constitution of silica and of alumina may be designated (Figure 1) in similar fashion to a six membered carbon ring. They may also be assumed to consist of five membered rings. This is the Hexite-Pentite theory. All silicates and aluminates may be shown theoretically to be a combination of hexite and pentite rings. Cement is considered not to be merely a calcium salt but a mixture of various silicates and aluminates. Each cement has a structural formula which varies with its chemical composition. As an example the formula in Figure 2 shows a cement of by no means the most complicated structure.

Martins conception of cement structure is based upon the idea that normal silicic acid, $Si(OH)_4$ has great "affinity for itself," and also that the silicon atom has both positive and negative valences. Ortho silicic acid is given this formula:

HO OH
Si
HO OH

where the solid lines are positive valences and the broken ones negative. Combination of two molecules is designated as in Figure 3.

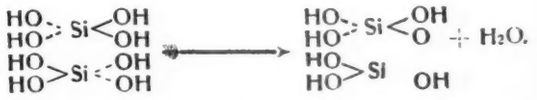


Figure 3

The oxygen ion has an "indifferent valence, and combines with any other free valence." Martin's formula is based further upon the hypothesis that proximity of calcium and silicon atoms to each other alters the behavior of the valences of these atoms, a sort of steric hindrance idea. Dicalcium silicate is given the structure shown in Figure 4

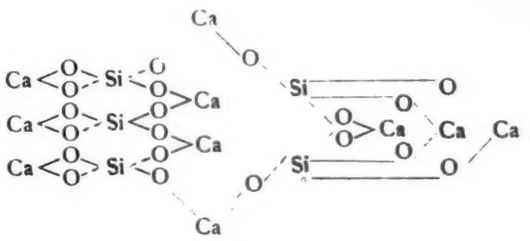


Figure 4

(10 CaO. 5 SiO_2). This silicate shows no hydraulic properties and was called "inactive cement silicate." The hydraulic "cement silicate" was assigned the empirical formula 13 CaO. 5 SiO_2 and given the structural arrangement shown in Fig. 5.

Many other formulas have been proposed, much other work has been done on this subject. R. H. Bogue is credited by the writer with the most important results in the exact determination of cement formation. He has determined (1) The volatile constituents of the raw slip, especially the carbonic acid, are given off at temperatures between 1,000 and 1,100 degrees C. This volatilization is an endotherimic reaction. (2) Between 1,100 and

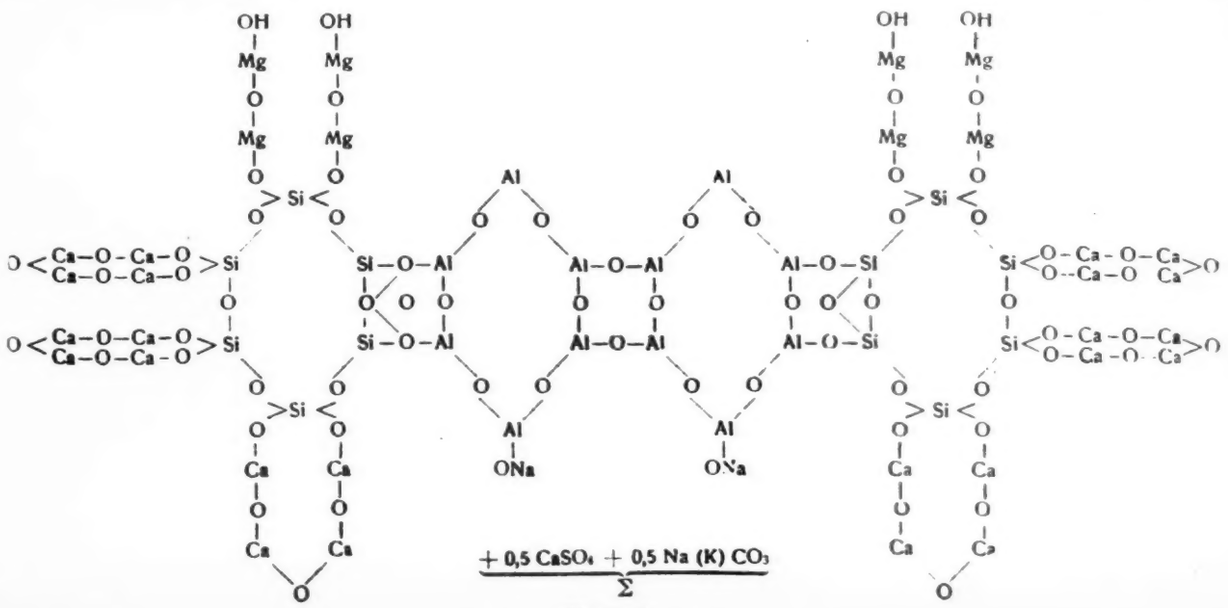


Figure 2

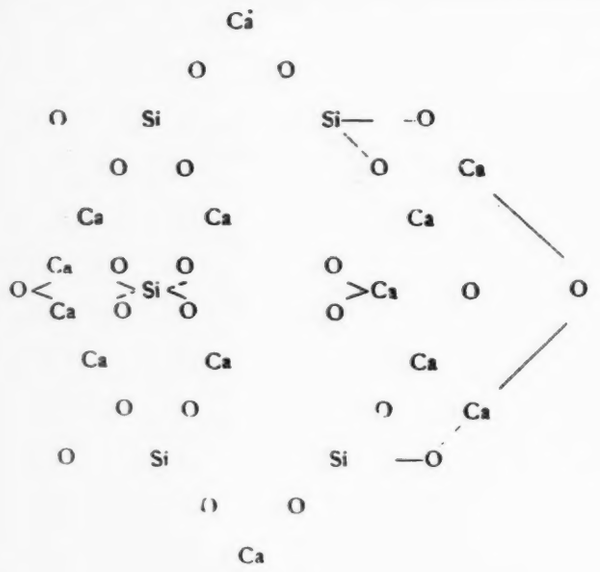


Figure 5

1,300 degrees C., lime and silica combine. The reaction is exothermic. The combination of lime with alumina and iron oxide is slight at this point. (3) The crystallization of silicates, aluminates and ferrites is of an endothermic nature, and takes place at various temperatures. H. Richarz (Tonindustrie Zeitung, April 18, 1928).

Magnesia Bricks

The physical, mechanical, and refractory properties of magnesite bricks from 32 different sources have been determined, and from the results obtained the samples have been divided into three groups, viz., those containing more than 7 per cent, those with 3 to 7 per cent and those with less than 3 per cent Fe_2O_3. These groups may be again subdivided into nine sub-groups the characteristics of which are tabulated. Magnesite bricks containing only silica as an impurity have a softening point under load of about 1790 degrees, which approaches that of bricks made of sintered magnesia; they have a high true specific gravity and low porosity, but a relatively high coefficient of expansion. Although the behavior of the bricks under load varied greatly with the composition, the refractoriness varied only slightly, all the samples withstanding exposure to a temperature above cone 42. X-Ray examination of well-burnt bricks showed that practically the whole of the magnesia has been converted into periclase, and therefore no further transformation should take place even after prolonged heating. Bricks containing 5 to 7 per cent Fe_2O_3 and very small amounts of silica have the best sintering properties and the greatest mechanical strength. H. Hirsch (Arch. Eisenhuttenw., *1*, 439-444, 1927; Stahl u. Eisen, *48*, 371-372 1928, and B. C. A.).

Measuring Setting Time of Cements

On measuring the electrical conductivity of gauged cement during setting and hardening, the specimen being maintained at constant temperature, the resistance suddenly changed at the moment corresponding to the final set, as defined by the maximum temperature change. The change in resistance is used to determine the time of setting, the mixed cement being contained in a small tube in a thermostat; two platinum electrodes are immersed in the cement and connected to a Kohlrausch alternating-current bridge. The rate of setting and hardening is influenced greatly by temperature, but the method is considered better adapted and more accurate than the mechanical and thermal methods. Y. Shimizu (Sci. Rep. Tohoku Imp. Univ. *17*, 85-92, 1928, and B. C. A.).

Burning of Cement

Air is blown at a relatively high pressure into a kiln for burning cement at a high point directly below the clinkering zone and also, at the same pressure, at lower points, including one below the grinding rollers, if desired. The air is introduced through pipes surrounding the kiln at suitable heights, fitted with branch pipes at regular intervals leading to the interior of the kiln. The kiln tapers towards the grinding rollers or outlet at the lower end. A. Andreas (B. P. 263, 166, 15.12.26, Ger. 16.12.25, & B. C. A.).

U. S. Per Capita Bank Resources

The banking power of the United States now amounts to approximately $587 for each resident of the country. This figure represents the aggregate of resources of virtually all banks in the country divided by the population. It is believed that in no other country in the world is the per capita bank resources figure as large as that of the United States.

New York leads all other states with bank resources of $1,664 per capita. Massachusetts ranks second and California third. In Massachusetts bank resources average $1,088 for each resident and in California the corresponding ratio is $897.

Rhode Island ranks fourth, Connecticut is fifth, Vermont sixth and New Jersey seventh. Pennsylvania ranks eighth, New Hampshire ninth and Delaware tenth.

The high ratio of the New England States is due to the large accumulation of savings deposits in that region in proportion to population. In no other section of the country are savings deposits as large as in New England in proportion to population.

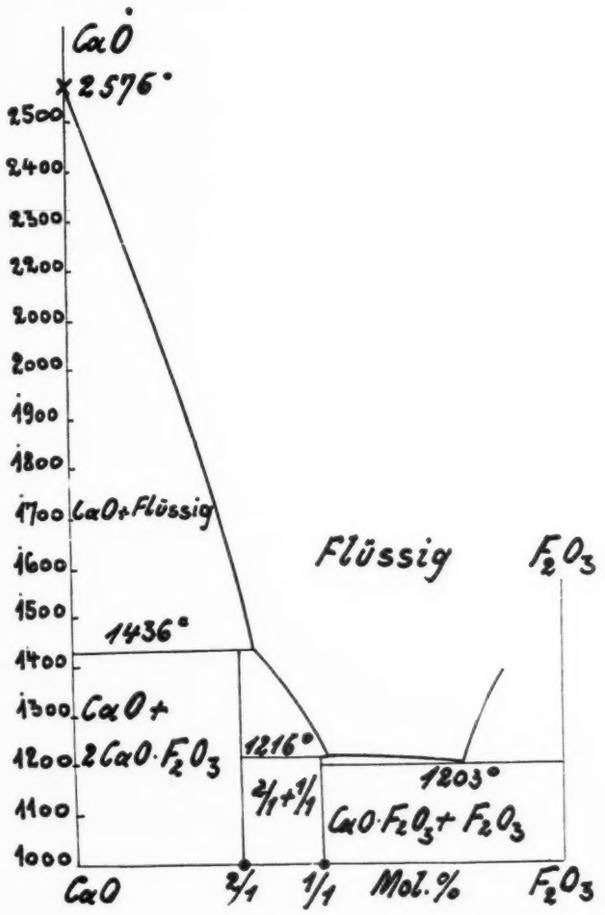


Figure 1

Alite

The Alite of Portland cement clinker is the compound 8CaO. Cl_2O_3. $2SiO_2$ Belite the compound B2CaO.SiO_2 Celite 2CaO. Fe_2O_3, in isomorphous mixture with 4CaO. Al_2O_3. Fe_2O_3. Felite is probably 2CaO. SiO_2. Alite and belite have similar structural formulae, in that in belite half of the silicon atoms are replaced by aluminum. They are isomorphs and give exactly similar X-Ray diagrams. Because of the peculiar melting relationships between alite and belite, mixed crystals are rarely formed, but remain separate. Additions which lower the melting point such as iron oxide, further the formation of mixed crystals. No compound corresponding to a tricalcium silicate exists. Strontium and barium alites exist, of the same formulae as calcium alite. The setting and hardening of cements depends upon the formation of calcium hydrate, dicalcium silicate-hydrate and dicalcium aluminate-hydrate. Alite is first decomposed with formation of the compounds, which usually corresponds to the setting of the cement. Belite is first gradually transformed ino the hydrate. Celite probably gradually goes over into the two compounds 2CaO. Al_2O_3. $6H_2O$ and 2CaO. Fe_2O_3. $6H_2O$. The decomposition takes place slowly, for undecomposed Alite has been found in hardened cement. Figure 1 shows the freezing point curve of CaO and Fe_2O_3, which shows that two compounds are formed 2CaO. Fe_2O_3 and CaO. Fe_2O_3. Figure (2) shows a diagram in triangular coordinates of various compounds formed from the three constituents, CaO, SiO_2 and Al_2O_3. E. Janecke (Zement, May 17, 1928).

The Chemical Composition of Cement

Cement hydrolyzes in a 1 per cent NaOH solution, about the same as in 5 per cent solutions. Only SiO_2 and Al_2O_3 were found in the dissolved part, and no colloidal Fe in the residue, showing that the hydrolyzed portion contains no Fe oxides. Assuming "Alite" to be the readily hydrolyzed part of cement, then "Alite" is composed only if SiO_2, Al_2O_3 and CaO. Analyses show a constant molecular relation $SiO_2/(Al_2O_3) = 3.75$. The residue not dissolved by a 5 per cent NaOH solution has the composition: $(a.SiO_2 + b.Al_2O_3 + c.Fe_2O_3)$ 2.44 $(m.CaO + n.MgO)$ and since "Alite" forms with this residue pure cement whose composition is: $(a.SiO_2 + b.Al_2O_3 + c.Fe_2O_3)$ 0.234 $(m.CaO + n.MgO)$ it follows that "Alite" should have the molecular composition: 3.75 SiO_2. Al_2O_3. 11.11 CaO. This molecular composition of "Alite" agrees well with the formula: $4(SiO_2.2CaO) + (Al_2O_3.3CaO)$ given by Keisermann for cement clinker. Increase in the ratio SiO_2: R_2O_3 in the undissolved residue shows that the yellow-brown substance has in the acid group a $SiO_2.R_2O_3$ ratio greater than 4.35. This substance contains all the Fe oxides found in cement. Since this yellow-brown substance resists action of a 5 per cent NaOH solution for 5 hours, it follows that it cannot be hydrolyzed by contact with H_2O and therefore does not take part in the setting of cement. From the semi-fused mass which forms cement there solidifies a eutectic in which the chemical equilibrium has been determined by the ratio RO: $(SiO_2 + R_2O_3) = 2.34$. "Alite" and the yellow-brown substance are deposited simultaneously. D. Ionescu Bujor. (Anelele minelor din Romania, 11, 31-36, & C. A., 1928).

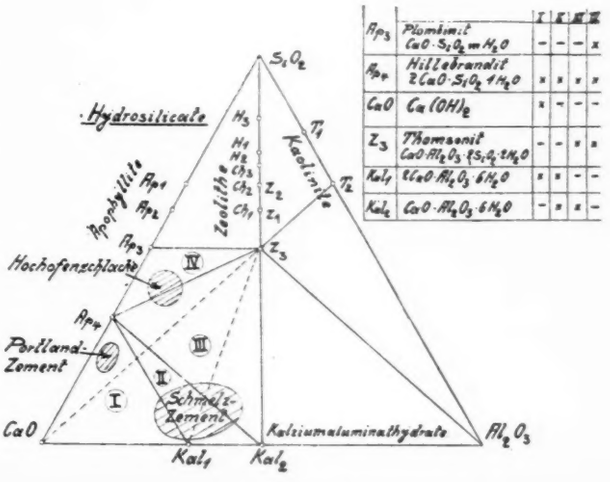


Figure 2

INTIMATE NEWS OF MEN AND PLANTS

Kansas Plant Resumes

The Blue River Sand and Gravel Plant at Blue Rapids, Kansas, recently resumed operations for the first time since its barge was destroyed by fire.

Yosemite Portland Is Host

One of the largest and most unique industrial parties ever staged in an industrial plant in the San Joaquin Valley took place at Merced, April 21, when more than 200 members of the San Joaquin Valley Lumber Dealers Association and their families were guests of the Yosemite Portland Cement Corporation. The party arrived at noon at the plant where a buffet luncheon was served in the cement warehouse, which was converted into a huge dining room. After luncheon the plant was inspected, each detail of the making of cement being explained by guides placed at convenient points on the tour. Following the inspection, games and sports were held on a field prepared for the occasion. At 5 o'clock all repaired to the dining hall to partake of a feast of barbecued meat which had been browning over glowing oak coals during most of the day.

The efficient management by Len Ellis was evident in the complete arrangements for the luncheon and barbecue. Mr. Ellis certainly knows how to cater to hungry crowds. As Valley representative of the Yosemite Portland Cement Company he is delivering similar courteous service to cement customers with the result that an increasing number of cars is leaving the plant each week.

Granite Company Expands

The J. P. Gilman Granite Company, 1302 Elmwood Avenue, Kansas City, Missouri, recently bought a factory site at the corner of Fairfax and Diagonal roads. Plans for a new plant to be erected at a cost of about $40,000 are being prepared, in which granite and marble will be cut, sawed, polished and carved. Officers of the company are: Leonard M. Gilman, president; S. A. Williams, secretary-treasurer, and Frank Backman, assistant secretary.

New Oregon Plant

The Oregon City Sand and Gravel Company recently opened a new sand and gravel plant at Fairfield (Gervais P. O.), Oregon, which has a capacity of about 150 cubic yards per day.

Zook Speaks on Cement

A. J. Zook, chief engineer of the Great Lakes Portland Cement Company, recently spoke on "The Electrification of the Cement Industry" at a meeting of the Niagara Frontier Section of the American Institute of Electrical Engineers held at the Hotel Statler, Buffalo, New York.

New Texas Cement Plant

Smith Brothers Properties, Incorporated, plans to start the construction in the near future of a $2,000,000 cement plant on an 800 acre tract of land 10 miles north of San Antonio, Texas, between the Missouri-Kansas-Texas and Missouri Pacific Railroads, according to an announcement recently made by Judge J. W. Young, vice-president of the company. In addition to the plant a water works and a sewer system with disposal plant will be installed. A separate corporation formed by Judge Young and J. H. Smith, president, will operate the plant.

Alabama Quarry Sold

The Alabama Oolitic Stone Company, with offices in the fourth and First National Bank Building, Nashville, Tennessee, has acquired a 160 acre quarry at Rockwood, Alabama. Two miles of track have been laid and production will be started as soon as necessary facilities are arranged, according to announcement by Wilbur F. Creighton. Other members of the corporation are A. D. Creighton, J. S. Dunbar and George H. Armstead, Jr.

Canadian Plant Enlarges

The Canadian Salt Company, of Sandwich, Ontario, plans to build an addition to its plant at a cost of $300,000.

Banquet Hall, Where Yosemite Entertained San Joaquin Valley Lumber Dealers

Large Quantities of Cement Exported by Japan

Japan produces over 2,000,000 tons of cement annually for export to the countries of the Asiatic Coast and the South Sea Islands according to K. Wakabayasha of the Asano Cement Company, Tokyo. Mr. Wakabayasha recently arrived in Seattle, Washington, to study the process of manufacturing quick hardening cement and new methods of transporting cement in bulk as is being done in this country.

Granite Company Expands

The McCauliff Quarry Company, Fitchburg, Massachusetts, of which Timothy R. Shea is treasurer, recently acquired 39 acres of land on Rollstone hill near that city. This acquisition merges into one firm half a dozen granite quarries which were formerly operated by independent operators.

Washington Plant Erects New Storage Bins

George Weber of Kelso, Washington, has begun the construction of gravel bins on the west bank of the Cowlitz river at the foot of Lincoln Street. Plans are to bring the gravel by barge from the Willamette river and other sources.

New Mica Drying Plant

The Franklin Mineral Products Company of Franklin, North Carolina, is constructing a mica drying plant adjacent to the railroad near the local depot, according to John Davenport, general manager of the company.

Indiana Industries Continue to Gain

Industrial activity in Indiana during the first part of 1928 has been maintained at a fairly high level and has justified for its part the statement of national economic services rating the north central group of states as the leader in this year's industrial progress, according to Charles F. Benzel, manager of the Indianapolis branch, Bureau of Business Research, Indiana University School of Commerce and Finance.

Limestone production in the Bedford-Bloomington district has shown perhaps the most outstanding increase, as it is more than 16 per cent ahead of the same period of 1927, and more than 10 per cent larger than the best corresponding four month total. The increase over 1927 so far amounts to about 500,000 cubic feet, in spite of the fact that April showed a decrease from a year ago.

Consolidations that have been effected are probably the most outstanding in Indiana in recent years and have made themselves strongly felt in this field. Production of Indiana limestone for building purposes was greater in 1927 than in 1926 and at present rates promises to beat 1927 by a sizeable margin. This increase, says Mr. Benzel, is largely due to the extensive advertising programs which are focussing increased attention on the use of natural stone as a building material.

Asphalt Industry in 1927

The demand for good roads by the millions of motorists in the United States has proved a boon to the asphalt industry, as its chief use is in paving and its consumption has increased. This is reflected in the statistics of the industry covering the year 1927 as compiled by G. R. Hopkins of the United States Bureau of Mines, Department of Commerce, which record total sales of asphalt and asphaltic materials manufactured from petroleum of 3,951,450 short tons, an increase over 1926 of 14 per cent. Of the total sales in 1927, 1,525,420 tons, or 39 per cent, was reported as having been produced from domestic crude petroleum and 2,426,030 tons, or 61 per cent, from foreign petroleum. This represents an increase in the proportion manufactured from domestic crude petroleum over a year ago, which may be attributed to a material decline in the use of Mexican crudes.

The average value of the sales of manufactured asphalt in 1927 was $13.87 per ton as compared with $13.46 in 1926. The average value of the asphalt manufactured from domestic crude petroleum was six cents per ton higher than a year ago, that from foreign crude petroleum seventy cents per ton higher. Paving asphalt of the solid and semi-solid class was again the chief variety of asphalt manufactured, comprising 42 per cent of the total output in 1927. The roofing and waterproofing branch of the industry used well over 1,000,000 tons of petroleum asphalt in 1927 and in doing so showed a larger percentage increase over the previous year than the paving asphalts.

Sales of natural asphalt and related bitumens, including bituminous rock, gilsonite, wurtzilite and ozokerite, at mines in the United States in 1927 amounted to 839,040 short tons, valued at $5,819,600. Sales of bituminous rock, the chief product of this group, amounted to 796,100 short tons, valued at $4,672,280, representing an increase over 1926 of 18 per cent in quantity and $0.52 per ton in average value. This material gain over 1926 resulted chiefly from increased developments in Texas, where sales for the first time in several years exceeded those of Kentucky, the other important producing State.

Imports of native asphalt and bituminous rock into the United States during 1927 amounted to 158,097 short tons, an increase over 1926 of 15,465 tons, or 11 per cent. Shipments from Trinidad and Venezuela, comprised 96 per cent of the total imports. The latter country made a notable gain over 1926 and seriously threatens to displace the former in first place. Exports of petroleum asphalt in 1927 amounted to 385,031 short tons, a gain over 1926 of 163 per cent. This extraordinary increase reflects the rapid increase in use of petroleum asphalt throughout the world. Germany and the Netherlands ranked first and second, respectively, as importers of asphalts from the United States.

Slag Association Elects

The eleventh annual meeting of the National Slag Association was held at the offices of the Association June 8, 1928. Among other business transacted, the following officers were re-elected for the ensuing year: C. L. McKenzie, Duquesne Slag Products Company, Pittsburgh, president; C. E. Ireland, Birmingham Slag Company, Birmingham, vice-president; and H. J. Love, 927 Leader News Building, Cleveland, secretary and treasurer.

San Juan Cement Expands

The Old Mission Portland Cement Company of San Juan, California, is building a 3 mile extension to its quarry railroad. This work includes a tunnel 340 feet long, 3 trestles over canyons, one of them 100 feet high, and the moving of 140,000 cubic yards of material.

Safety for Cement Plants

Methods for reducing accidents in cement mills and plans for coordinating the safety work at the Lehigh Portland Cement mills were discussed at a meeting held recently. The meeting was opened by R. B. Fortune, general manager of the Penn-Dixie. Speakers on the program were W. H. Hamilton, Alpha Portland Cement Company; Fred B. Hunt, electrical engineer, Nazareth Portland Cement Company; W. P. Gano, assistant manager, Pennsylvania-Dixie Cement Corporation; W. A. Turnbach, Hercules Powder Company; Joseph Brobson, vice president, Nazareth Portland Cement Company; and many others prominent in the advancement of safety methods.

DISTRIBUTION OF CEMENT

The following figures show shipments from Portland cement mills distributed among the States to which cement was shipped during March and April, 1927 and 1928.

Portland cement shipped from mills into states from March and April, 1927 and 1928, in barrels*

Shipped to—	March		April	
	1927	1928	1927	1928
Alabama	141,921	282,379	173,893	233,865
Alaska	305	264	1,037	542
Arizona	45,602	81,586	47,573	64,808
Arkansas	59,114	101,428	53,331	86,513
California	1,094,778	937,253	1,137,845	1,058,739
Colorado	47,912	60,381	86,431	90,312
Connecticut	109,035	113,752	179,863	187,697
Delaware	24,826	19,230	40,699	26,177
District of Columbia	95,396	62,160	89,048	66,108
Florida	290,682	114,798	271,575	134,647
Georgia	169,167	157,171	168,681	155,787
Hawaii	19,615	39,411	25,876	19,314
Idaho	35,047	23,994	32,063	30,832
Illinois	752,148	700,881	956,012	1,192,251
Indiana	273,970	232,338	418,874	355,434
Iowa	147,119	149,705	211,248	405,654
Kansas	166,110	194,957	203,368	202,705
Kentucky	112,435	103,113	158,567	130,168
Louisiana	134,893	115,669	107,023	112,667
Maine	20,132	18,704	39,031	30,015
Maryland	231,780	123,334	224,405	176,807
Massachusetts	193,283	160,730	293,606	256,150
Michigan	527,829	433,110	857,574	710,731
Minnesota	147,967	128,332	258,506	185,901
Mississippi	75,149	73,937	78,127	73,651
Missouri	287,825	333,221	312,311	383,704
Montana	19,365	27,231	23,882	32,676
Nebraska	81,860	88,491	96,255	108,224
Nevada	7,665	7,568	10,406	7,195
New Hampshire	25,391	25,575	43,932	34,667
New Jersey	611,542	505,016	897,645	778,746
New Mexico	32,564	30,606	28,566	27,664
New York	1,511,091	1,237,218	2,131,528	1,758,888
North Carolina	235,316	209,006	324,758	199,340
North Dakota	20,429	18,274	38,157	34,627
Ohio	587,797	540,347	837,050	776,992
Oklahoma	235,301	294,206	242,747	209,850
Oregon	91,820	78,121	122,281	102,480
Pennsylvania	865,043	657,006	1,199,544	928,060
Porto Rico	2,500	1,329	1,000	0
Rhode Island	50,746	47,707	78,743	81,029
South Carolina	71,247	119,612	82,680	101,838
South Dakota	31,724	25,694	35,465	42,599
Tennessee	137,431	174,774	180,574	216,928
Texas	481,261	546,960	472,879	526,063
Utah	25,741	35,955	31,793	36,932
Vermont	9,397	14,737	30,185	27,791
Virginia	124,387	173,697	135,226	175,192
Washington	229,012	162,335	248,518	237,749
West Virginia	97,094	81,273	112,009	103,682
Wisconsin	221,345	148,969	356,961	287,693
Wyoming	10,293	13,571	14,783	15,229
Unspecified	14,749	57,761	102,398	41,738
	11,034,151	10,084,877	14,296,532	13,265,051
Foreign countries	65,849	50,123	53,468	41,949
Total shipped from cement plants	11,100,000	10,135,000	14,350,000	13,307,000

* Includes estimated distribution of shipments from three plants in March and April, 1928, and in April, 1927; and from five plants in March, 1927.

Production, shipments, and stocks of finished Portland cement, by months, in 1927 and 1928. (In thousands of barrels)

Month—	Production		Shipments		Stocks at end of month	
	1927	1928	1927	1928	1927	1928
January	8,258	9,768	5,968	6,541	22,914	25,116
February	7,377	8,797	6,731	6,563	23,563	27,349
March	11,450	10,223	11,100	10,135	23,922	27,445
April	14,048	13,468	14,350	13,307	23,654	*27,627
May	16,701	17,280	16,865	18,986	23,503	25,921
June	17,224	.....	19,761	.....	20,972	.....
July	17,408	.....	18,984	.....	19,397	.....
August	18,315	.....	21,411	.....	16,292	.....
September	17,505	.....	19,828	.....	13,996	.....
October	17,174	.....	18,105	.....	13,141	.....
November	14,449	.....	11,619	.....	16,022	.....
December	11,999	.....	6,200	.....	*22,082	.....
	171,908	.....	170,922	.....	.....	.....

Production and stocks of clinker, by months, in 1927 and 1928. (In thousands of barrels)

Month	Production		Stock at end of month		Month	Production		Stock at end of month	
	1927	1928	1927	1928		1927	1928	1927	1928
Jan.	10,410	11,839	9,989	9,672	July	15,697	.....	9,609	.....
Feb.	9,253	11,363	11,943	12,237	Aug.	16,396	.....	7,887	.....
Mar.	12,397	12,601	12,997	14,463	Sept.	15,931	.....	6,490	.....
Apr.	14,246	13,844	13,335	*15,002	Oct.	16,469	.....	5,960	.....
May	15,677	16,025	12,514	13,964	Nov.	14,698	.....	6,374	.....
June	15,437	.....	10,926	.....	Dec.	13,177	.....	7,660	.....

* Revised.
† Maine began producing April, 1928, and shipping May, 1928.

Relation of Production to Capacity

	May		April	March	February
	1928	1927	1928	1928	1928
	Per cent	Per cent	Per cent	Per cent	Per cent
The month	86.6	88.9	70.0	51.7	47.5
The 12 months ended	73.9	75.5	74.0	74.6	75.1

CEMENT STATISTICS FOR MAY, 1928

The Portland cement industry in May, 1928, produced 17,280,000 barrels, shipped 18,986,000 barrels from the mills, and had in stock at the end of the month 25,921,000 barrels, according to the United States Bureau of Mines, Department of Commerce. The production of Portland cement in May, 1928, showed an increase of 3.5 per cent and shipments an increase of 12.6 per cent, as compared with May, 1927. Portland cement stocks at the mills were 10.3 per cent higher than a year ago. The total production from January to May, 1928, inclusive, amounts to 59,536,000 barrels compared with 57,834,000 barrels in the same period of 1927, and the total shipments from January to May, 1928, inclusive, amount to 55,532,000 barrels as compared with 55,014,000 barrels in the same period of 1927.

The statistics here presented are compiled from reports for May from all manufacturing plants except two for which estimates have been included in lieu of actual returns. They include the output of another new plant, located in Washington, which began operating during the month.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 157 plants at the close of May, 1928, and of 146 plants at the close of May, 1927.

Recent Patents

1,668,924. Lime-hydrating apparatus. John C. Schaffer, Pittsburgh, Pa., assignor to Schaffer Poidometer Co., same place.

1,670,152. Mining apparatus. Morris P. Holmes, Claremont, N. H., assignor to Sullivan Machinery Co.

1,670,153. Mining-machine. Morris P. Holmes, Claremont, N. H., assignor to Sullivan Machinery Co.

1,670,154. Clutch mechanism for mining-machine trucks. Morris P. Holmes, Claremont, N. H., assignor to Sullivan Machinery Co.

1,670,155. Mining-machine. Morris P. Holmes, Claremont, N. H., assignor to Sullivan Machinery Co.

1,670,269. Cooling and drying apparatus and process of cement making adapted to be carried on thereby. Hugo O. Moebius, Hanover, Germany, assignor to American Miag Corporation, Buffalo, N. Y.

1,668,166. One-piece drag-line bucket. Walter S. McKee and Wesley G. Nichols, Chicago, Ill., assignors of one-half to American Manganese Steel Co., Chicago, and one-half to said Walter S. McKee.

EXPORTS AND IMPORTS

Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision

Exports of hydraulic cement by countries in April, 1928

Exported to—	Barrels	Value
Canada	2,470	$ 13,566
Central America	2,794	7,516
Cuba	6,281	17,935
Other West Indies and Bermuda	6,267	14,419
Mexico	6,085	20,507
South America	30,570	94,945
Other countries	7,209	36,994
	61,676	$205,682

Imports of hydraulic cement by countries, and by districts, in April, 1928

Imported from—	District into which imported	Barrels	Value
Belgium	Florida	993	$ 1,019
	Galveston	8,001	9,609
	Hawaii	4,153	5,234
	Maine and New Hampshire	15,000	20,313
	Massachusetts	93,004	122,538
	New York	10,968	13,792
	North Carolina	12,400	15,497
	Oregon	14,000	17,400
	South Carolina	36,940	46,417
	Washington	10,962	15,484
	Total	206,421	267,303
Canada	Maine and New Hampshire	1,166	2,405
	Vermont	349	484
	Total	1,515	2,889
Denmark	Porto Rico	36,044	44,860
France	New York	1,491	3,297
United Kingdom	New York	1,511	2,732
	Philadelphia	2,476	3,290
	Total	3,987	6,022
	Grand Total	249,458	324,371

Exports and imports of hydraulic cement, by months, in 1927 and 1928

	Exports				Imports			
	1927		1928		1927		1928	
Months	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	75,346	$ 254,072	65,400	$204,875	193,175	$ 269,661	234,753	$342,797
February	71,404	233,985	62,828	221,620	130,421	200,680	164,408	217,525
March	67,956	240,165	74,983	265,719	181,145	261,519	235,930	330,074
April	72,383	243,832	61,676	205,882	192,318	313,262	249,458	324,371
May	59,332	205,574	.....	.....	178,929	263,618	.....	.....
June	69,205	237,281	.....	.....	129,111	201,682	.....	.....
July	72,337	249,737	.....	.....	175,042	249,665	.....	.....
August	61,371	209,198	.....	.....	117,605	170,167	.....	.....
September	57,890	207,817	.....	.....	233,066	304,796	.....	.....
October	67,639	230,668	.....	.....	221,274	321,777	.....	.....
November	79,764	257,528	.....	.....	141,485	190,419	.....	.....
December	62,099	226,960	.....	.....	156,609	209,205	.....	.....
	816,726	$2,796,717	.....	.....	2,050,180	$2,956,451	.....	.....

Domestic hydraulic cement shiped to Alaska, Hawaii and Porto Rico, in April, 1928

	Barrels	Value
Alaska	1,217	$ 3,646
Hawaii	35,744	92,054
Porto Rico	2,555	7,043
	39,516	$102,743

Production and stocks of clinker (unground cement), by districts, in May, 1927 and 1928 (in thousands of barrels)

	Production		Stocks at end of month	
District	1927	1928	1927	1928
Eastern Pa., N. J. & Md.	3,686	3,650	1,745	1,936
New York & Maine	1,014	1,192	570	1,042
Ohio, Western Pa., & W. Va.	1,523	1,686	1,611	1,903
Michigan	1,364	1,270	1,668	1,879
Wis., Ill., Ind. & Ky.	2,027	1,857	1,793	2,012
Va., Tenn., Ala., Ga., Fla., & La.	1,439	1,247	903	957
Eastern Mo., Ia., Minn., & S. Dak.	1,287	1,596	809	1,011
Western Mo., Nebr., Kans. & Okla.	1,003	1,098	643	580
Texas	488	546	169	179
Colo., Mont. & Utah	16*1	285	760	421
California	1,319	1,243	1,190	1,420
Oreg. & Wash.	366	355	653	634
	15,677	16,025	12,514	13,964

Indiana University Conducts Lime Research

Dr. F. C. Mathers and K. W. Ray of the Indiana University chemistry laboratories, Bloomington, Indiana, have recently completed laboratory studies showing how the quality of lime produced by burning limestone can be controlled to produce best results in such commercial uses as plastering, water softening, wool washing and purification of sewage. Using pure Oolitic limestone from that section, the chemists show how differences in temperature of the burning limestone cause differences in properties of lime formed.

National Silica Operates Magnesia Mines

The National Silica Products Company of Palo Alto, California, is operating the mines about four miles from Lampos which were formerly owned by the National Magnesia Manufacturing Company. The plant at Redwood City, which was transferred to the Celite Products Company, did not include the mines in the transaction. The diatomaceous earth, which increases the workability of concrete, is being mined and marketed under the trade name, Dia-sil.

Vermont Marble to Develop Montana Deposit

The Vermont Marble Company will open a quarry in Broadwater County, Montana. Machinery has arrived at the Townsend station to be used in the new project.

Granite Company Expands

The J. P. Gilman Granite Company of Fairfax, Missouri, has given a contract to P. J. Bares of Kansas City for the construction of three additional buildings. The cost of the buildings is estimated at $40,000.

Gravel Separator Installed

A separator for the purpose of removing lignite, sawdust and other foreign matter is being installed by the Greenville Stone and Gravel Company at North Greenville, Mississippi. According to Manager Everett McCord, the separator, which will greatly improve the quality of the product, will be 32 feet high by 11 feet long.

A New Jersey Pit

Jonathan F. Stout, of Atantic Highlands, New Jersey, a general contractor, recently purchased 9¾ acres of land between that city and Chapel Hill from which he plans to obtain gravel and stone needed in his business.

Cement Company Banquets Safety Organization

In celebration of the remarkable record made by its Redwood City, California plant, the Pacific Portland Cement Company recently gave a luncheon to its employes. The plant has operated for one year without having a lost time accident. Congratulatory addresses were made to the 300 invited guests by R. B. Henderson, president; J. L. Colton, vice president; A. G. Lang, chief engineer; and W. G. French, head of the State Industrial Accident Commission.

New Illinois Pit

The Ebert Washed Sand and Gravel Company of Peoria, Illinois, recently filed articles of incorporation and has commenced work near Farmdale. The incorporators are M. Ebert, G. W. Ebert, and Frank Blumenshine. The board of directors are M. Ebert, Frank Blumenshine, Joseph Nofsinger, Clyde Smith and F. M. Ebert, who also hold stock in the company.

New Indiana Plant

A new stone company is erecting a plant in Bloomington, Indiana, near the Walnut street pike. Thomas Roberts is president of the company, John Wilson is vice president and Charles Colgren is secretary-treasurer.

Natural Abrasives in 1927

The production of miscellaneous natural abrasives sold by producers in the United States in 1927, as reported by the United States Bureau of Mines, Department of Commerce, is shown in the following table:

	1927	
Abrasive	Short tons	Value
Emery	506	$ 5,855
Garnet	6,939	573,525
Grinding pebbles and tube-mill lining	3,342	46,856
Grindstones	23,682	659,067
Millstones, chasers and dragstones		35,438
Oilstones, whetstones, hones, scythestones, and rubbing stones	932	233,080
Pulpstones	8,249	895,743
Pumice	53,298	221,481
Tripoli	26,099	447,068

In addition, there were manufactured and sold during the year 90,626 short tons of artificial abrasives, valued at $7,959,891, divided as follows: Carbides, 26,289 short tons, valued at $2,603,571; aluminum oxides, 50,973 short tons, valued at $4,516,637, and metallic abrasives, 13,364 short tons valued at $839,683.

Tarmac Road Surfacing

The American Tar Products Company with offices at Pittsburgh, Pennsylvania, recently published an illustrated bulletin showing different methods by which gravel and macadam roads and streets can be improved by treating them with Tarmac. This is made in five forms: Tarmac A for hot surface treating; T for penetration macadam; P for cold surface treating; CP for cold patch and cold mix, and HP for hot patch and crack filler.

Marquette Cement Acquires New Stone Quarry

The Marquette Cement Manufacturing Company of Cape Girardeau, Misouri, has taken possession of Marquette Guernsey Farm and begun stripping operations to recover limestone. Levees are being constructed about the property and preparations are being made for removing the soil by hydraulic stripping.

Incorporations

Franklin Sand & Cement Products Co., Ridgewood, Brooklyn, N. Y.

Pioneer Sand Co., 1117 Juliana St., Parkersburg, W. Va. 500 shares, $100 each; 1,000 shares n.p.v. W. E. Shivers, Pres. & Gen. Mgr.; Robert H. Renshaw, Jr., S. D. Archbold, A. L. Shivers, James S. McCluer.

Quality Granite Co., St. Cloud, Minn. $50,000. Will open two granite quarries on state highway. Arthur M. Emmel, Pres.; Andrew Hagberg, V. P.; Nicholas Stein, Treas.; John M. Emmel, Sec.

Vienna Sand & Gravel Co., Hawthorne, N. J. Harry A. Bysterbusch, Garrit Bysterbusch, Hawthorne; Wm. Youngster, Anna M. Youngster, Totowa, N. J.

Broome County Sand & Gravel Corp., care Dunmore, Ferris & Dewey, Utica, N. Y. $70,000 pfd., 1,000 shares n.p.v.

Baker Gravel & Sand Co., Mobile, Ala. $25,000. John G. Murphy, Pres.; C. G. Baker, V. P. & Mgr. of Prod.; A. T. Baugh, Jr., Sec.-Treas.-Sales Mgr.; Anna M. Murphy; Henry J. Murphy.

A. Serino Construction Co., care W. H. Gilman, Long Island City, N. Y. $10,000. Sand and gravel.

Pan Handle Sand & Gravel Co., care Corp. Trust Co., Wilmington, Del. $200,000; 100,000 shares n.p.v.

Camden Gravel Co., Camden, S. C. $35,000. J. B. Zemp, Pres.; J. P. Wilson, V. P.; T. K. Trotter, Sec.-Treas.

Sturgisson Sand Co., Sturgisson, Greer P. O., W. Va. $20,000. Martin Bloiarz, Star City, W. Va.; Frank Micholski, Andy Smoler, Stanley Rybicki, Andy Rabacz, all of Sturgisson.

Gwynns Falls Stone Corp., 502 Highland Ave., Towson, Baltimore, Md. Bruce S. Campbell.

Florida Quarries & Constr. Co., Harvey Bldg., W. Palm Beach, Fla. C. L. Nelson.

Alabama Oolitic Stone Co., Fourth & First Nat. Bk. Bldg., Nashville, Tenn. $25,000. W. F. Creighton (Pres., Foster & Creighton Co., same address), A. D. Creighton, J. S. Dunbar, Jr., R. B. Dunbar, George H. Armistead, Jr. Will open a quarry at Rockwood, Ala.

Aroostook Traprock Co., Presque Isle, Me. $100,000. Clarence A. Powers, Pres., Ft. Fairfield, Me.; Nathan F. Perry, Treas., Presque Isle. Will mine trap rock for highway construction.

Cape Ann Quarries, Inc., Gloucester, Mass. $50,000. Sarah K. Kenney, Sarah A. Corrigan, Emma Leitiger. Granite.

English Mica Co., Glens Falls, N. Y., care Begg, Begg & Begg, 280 Broadway, Manhattan, N. Y. $50,000.

Kaolin Corp. of Pa., care Corp. Guarantee & Trust Co., Wilmington, Del. $250,000. 8,000 shares n.p.v. J. Vernon Pimm, E. M. MacFarland, Philadelphia; R. L. Spurgeon, Wilmington, Del.

Gold Bond Products Corp., Buffalo, N. Y. Lime, cement. 200 shares, n.p.v. Directors: Paul F. Kleasons, Elmer E. Finck, Nettie A. Jerge, all of 804 Liberty Bank Bldg., Buffalo, N. Y.

Consumers Rock & Gravel Co., care Corp. Trust Co. of Amer., Wilmington, Del. $1,600,000; 150,000 shares n.p.v.

Builders Sand & Gravel Co., Wheeling, W. Va. $25,000. G. Alan Garden, Elizabeth Renant, Howard D. Matthews, Ella Morrell, Jessie Flading.

Lexington Quarry Co., Lexington, Ky. $20,000. Daniel B. Midkiff, Louis M. Winges, Bernardine Winges.

Pulpit Rock Corp., Essex Falls, N. J. 1,000 shares n.p.v.

C. W. Lovell Promoted

The Kentucky Consolidated Stone Company, which was recently organized in Kentucky with offices in Louisville, recently appointed C. W. Lovell as chief engineer and sales manager. Mr. Lovell is a graduate civil engineer, member of the American Society of Civil Engineers, and has had thirteen years' experience in the Kentucky Highway Department.

NEWS OF EQUIPMENT MANUFACTURERS

Smith Engineering Moves Chicago Office

The Chicago office of the Smith Engineering Works, formerly in the Old Colony Building, is now located in the Builders Building. Victor H. Jones continues as district manager.

Largest Shovel Ever Built

The operation of The Northern Illinois Coal Corporation near Wilmington, Illinois, is unique in that it is an entirely new project, laid out in a scientific manner and completely equipped with modern and efficient machinery. Three electric excavators are used, which include a type 360 electric dragline, a type 5480 electric stripping shovel and a type 37 coal loading shovel, all built by The Marion Steam Shovel Company of Marion, Ohio.

The type 5480 is the largest shovel ever built and its introduction is a distinct forward movement in meeting the demand for higher capacities and lower unit costs of handling material. The shovel carries a 12 cubic yard dipper on a 90 foot boom and a 60 foot dipper handle. It is mounted on crawling traction trucks and is operated electrically from the power lines of the public utility company serving that territory. A 750 h.p. motor drives the motor generator set for furnishing power to the various motions and the working weight with ballast is approximately 850 tons.

The shovel operates three 8-hour shifts daily and it has handled 15,481 cubic yards in a twenty-four hour period. It is expected that in a calendar year it will handle from two to three million cubic yards of material.

Prior to the erection of the type 5480, the largest coal-stripping unit had been the Marion type 350 which carried an 8 cubic yard dipper, a 90 foot boom and a 58 foot dipper handle. This machine operated effectively and economically in overburden up to 40 feet in thickness where the vein of coal averaged 5 feet in depth. However, there is much stripable coal having an overburden not exceeding 40 feet in thickness, where the coal averages only 3½ feet. It was to operate under the later condition that the new shovel was developed, although, as in the case of the Northern Illinois Coal Corporation, its use may be extended to a thicker coal vein with a consequent decrease in production costs.

Best Brothers to Enlarge

The Best Brothers Keene's Cement Company plans to build a one story addition to its plant at Medicine Lodge, Kansas. The building will be 80 by 100 feet and will cost approximately $75,000 with equipment.

Magnetic Clutches Described

The Magnetic Manufacturing Company, in its 8 page illustrated Bulletin No. 72, describes the "High-Duty" magnetic clutches. These clutches are composed of two elements, in one of which the magnet winding is mounted, the other comprising the armature. Normally the elements stand a short distance apart but when the circuit is closed and current passing through the winding energizes the steel and builds up a strong magnetic field in the driving member. This attracts the driven member and the clutch gradually engages as the magnet builds up its full power, giving a smooth acceleration. When the circuit is opened the clutch disengages and the two elements again assume their normal clearance. No manual effort is required to operate the clutch as this is done by one or more push buttons located in convenient places.

Electric Shovel at Plant of the Northern Illinois Coal Corporation

Putting Gravity to Work

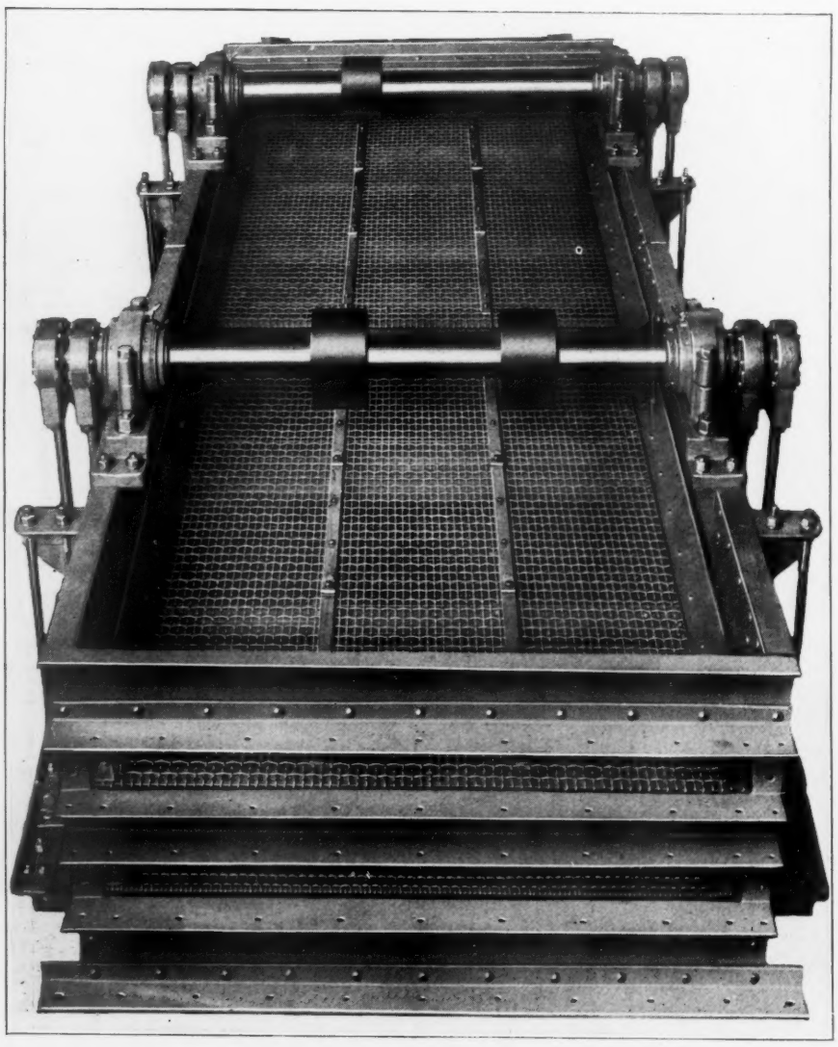
The Neff and Frye Company of Camden, Ohio, is distributing a 4 page illustrated leaflet under the caption "Work with Nature, Not Against It." In a unique photograph the old shovel gang is shown, loading material into a truck, while on the opposite page, gravity bins are shown loading a fleet of trucks and eliminating arduous and expensive shoveling. "The Song of the Silo" which was "Written in the Super-Concrete Stave" is enclosed with the leaflet.

The Pittsburgh Vibrator

The Pittsburgh Coal Washer Company is distributing its illustrated 6-page bulletin 52 which describes the Pittsburgh vibratory screen. The illustrations show several double deck tandem and single unit screens in operation.

The vibratory action of the screen is accomplished through an eccentric shaft, mounted in self aligning ball bearing pillow blocks, which impart a definite and positive vibratory action to both the screen and frame. The vibratory action is always constant and continuous through every revolution of the driving shaft, regardless of the variable loads imposed. Moving and wearing parts are outside the path of the material to be screened which eliminates the causes of wear and depreciation. The maximum power required is 1½ and 3 h. p. respectively for the single and double deck tandem.

Construction features of the screen include a cloth of suitable mesh, mounted on a steel frame and securely fastened to the supporting members which are carried on coil springs. These float the screen frame and permit it to vibrate freely under the load. A rigid connecting rod is attached to each end of the spring supports, which are connected to the main drive shaft. The main shaft is ground to fit the bearings and finished to three inches in diameter and all bearings are equipped for either Alemite or Dot high pressure lubrication.



A New Double Deck Vibrating Screen

American Blowers Described

The American Blower Company of Detroit, Michigan, in its 76 page illustrated bulletin No. 8501, describes the "Sirocco" line of fans and blowers. These are made in many sizes and in both single and double inlet styles with a volume of 33.1 to 466,000 cubic feet per minute and an outlet velocity of 1,000 to 7,000 lineal feet per minute.

The blast wheel is a centrifugal fan wheel constructed with 64 narrow, curved, die-formed blades, securely riveted to the driving disc and rim in such a manner as to form a rigid drum. These blades are set at such an angle as to give a high velocity to the air leaving the tips, and the large number of blades insures constant air velocity. The hub is a cone shaped iron casting riveted to the driving disc, smoothly machined, and sloping toward the inlet to deflect the air to the blades. The driving disc and rim are of steel plate construction, die punched to insure accurate location of the blades and the shaft is hot rolled carbon steel or a steel forging, depending on the size. Forged carbon steel tension rods are used in the larger wheels and are so placed as not to obstruct the free inflow of air. Housings are of cast iron in the smaller sizes and in the larger are made of steel plate, braced with angles or channel sections. Double ring, self-oiling bearings and pillow block type bearings for heavy duty are standard, but ball bearings can be furnished in the knee type for small sizes and the pillow block type for large sizes.

These fans are made in seven standard arrangements designed to suit any conditions and can be obtained in either clockwise or counterclockwise styles, with up or down blast, bottom or top, horizontal or angular discharge. All styles are made with full housings but in the larger sizes a ⅞ housing is also made. Many types of drive can be used, among them being the direct connected electric motor.

New Zelnicker Bulletin

The Walter A. Zelnicker Supply Company of St. Louis, Missouri, is distributing bulletin number 362, listing new and used gasoline and oil engines, oil engine driven generators, and tanks.

Boston Hose Elects

The Boston Woven Hose and Rubber Company of Boston, Massachusetts, recently appointed A. C. Kingston assistant general manager in charge of sales and member of the board of directors.

Pierce Governor Moves Into New Factory

On Friday, June 15, the Pierce Governor Company of Anderson, Indiana, practically completed the transfer of its entire factory and executive offices from Ninth Street and Central Avenue to the new plant at 1605-1635 Ohio Avenue. The plant was recently acquired from the R. J. Wright Manufacturing Company and has been completely reconstructed and remodeled at an expense of approximately $50,000. This has made the new Pierce factory most modern and up-to-date.

The building is of concrete, brick and steel construction, with but very little wood. It has a little over 40,000 square feet of floor space and will give the Pierce Governor Company room for much needed expansion. A new heating system has been installed that is of the very latest unit type, steam radiation. The boiler is heated by an oil burner, and a storage tank has been installed on the railroad siding that enables it to transfer the fuel oil to the tank without handling.

Much new machinery and equipment has been added to the new plant. An entire new addition, 50 by 75 feet, was built at the southwest of the plant, to house a portion of the power roller department. It is rumored that the Pierce Governor Company is very shortly going to announce some new equipment that will provide absolute automatic control of carburetion, and eliminate the necessity of hand choking.

The ground purchased with the new plant is almost four acres in area, giving ample room for expansion and the erection of new buildings as needed. At the present time 357 manufacturers of automotive and industrial machinery use Pierce Governors as standard equipment.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20c each. State number of patent and name of inventor when ordering.

1,670,381. Crusher-roll. Charles B. Rogers, Joplin, Mo.

1,670,425. Finishing-lime and process of making it. Ernest O. Schnell, St. Louis, Mo.

1,670,470. Boom for shovel-excavators. Hens F. Menck, Altona, Germany.

1,670,677. Process of and apparatus for mixing and applying mortar. Horatio W. Brown, Concord, Mass., assignor to Bemis Industries, Inc., same place.

1,670,714. Attrition-grinder. James A. Craig, Peekskill, N. Y.

1,670,773. Power excavating-machine. Hermann Lemp, Erie, Pa., assignor to Bucyrus-Erie Co., South Milwaukee, Wis.

Comp—P&q — Comp— Kehm— 6-18

1,671,215. Skip-hoist system. William P. Alexander, Merchantville, N. J., assignor to R. H. Beaumont Co., Philadelphia, Pa.

1,671,233. Drag clam. Harris T. Dunbar, Buffalo, N. Y.

1,671,444. Grab. Almon E. Norris, Brookline, Mass.

1,672,122. Wharf. Horace P. Hamlin, Montclair, N. J., assignor to Raymond Concrete Pile Co., New York, N. Y.

1,672,380. Method of curing concrete. Robert B. Gage, Trenton, N. J.

1,673,051. Rotary kiln for burning, roasting, and sintering of mineral materials. Fritz Luther, Dessau, Germany.

1,673,097. Three-way swinging valve for concrete-mixers. George E. Webb, Milwaukee, Wis., assignor to Koehring Co., same place.

1,673,148. Resilient suspension means for screen-separators, John F. Isbell, Alhambra, Cal.

1,673,161. Mine-car. Hugh W. Sanford, Knoxville, Tenn.

1,673,453. Mine-car. Wilbur D. Hockensmith, Irwin, Pa.

1,673,465. Pulverizing machine. Wilson L. & Herrold L. McLaughlin, Des Moines, Iowa.

Link-Belt Issues Data

If the amount of usable information put into a general catalog is any criterion of its worth, then the Link-Belt General Catalog 500, published by Link-Belt Company, of Chicago, Indianapolis and Philadelphia is a good example of what an informative general catalog should be.

It consists of 1088 pages and not only covers in engineering data and list prices, the complete chain, sprocket, power transmission, elevating and conveying and engineering divisions of that company's business, but contains considerable data for which the engineer has use.

In developing this book, it was evidently their purpose not only to make its contents of engineering information so ample that engineers might design plants of a standard character without their aid, but also to supply price lists so complete as to enable the experienced buyer to determine net prices of his purchases.

The book is admirably arranged to serve these purposes. In addition to being an unusual engineering catalog, it is a text book of the conveying, elevating and chain transmission art.

New home of the Pierce Governor Company

New G. E. Data

The General Electric Company is distributing several illustrated loose leaf bulletins which are perforated for incorporation into the general catalog. Many of the bulletins are new and original, while others are intended to supersede portions of the catalog.

GEA-197A, "Mechanical Drive Turbines," type D-54 are made condensing or non-condensing up to 500 h. p. and from 1200 to 4000 r.p.m. The operating principle permits simplicity of design, large clearances and assures both initial and sustained economy.

GEA-360B, "CR 7761-Fi, Remote Indicating Speed Controller," designed for A. C. slip ring and induction motors. This control is described as the simplest ever designed by the company; combining remote adjustment with visual speed indication for fan and blower services.

GEA-383B, "Low Speed Synchronous Generators," types ATB and ATI designed for direct connection to steam and internal combustion engines. These were developed to insure strength without excess weight. These generators are built in all capacities required by engine builders.

GEA-468A, "CR 3105 Drum Type Controllers" were developed for use with direct current adjustable speed motors. These were particular designed for use with motors that drive machine tools, requiring frequent starting, stopping or speed adjustments.

GEA-569A, "Constant Potential Arc Welding Sets" are recommended for any number of operations up to capacity, either metallic or carbon electrode welding. These sets are designed to generate direct current at 60 volts at all ampere outputs up to their rated capacity.

GEA-588A, "Centrifugal Air Compressors," in which gears are used to step up the speed of the driver to that required for the compressor.

GEA-724A, "Totally enclosed Fan Cooled Induction Motors" are made in three or two phase, 60 cycles and 220, 440 and 550 volts and 1½ to 15 h. p.

GEA-743A, "CR 3202 Drum Controllers" made for two or three slip ring induction motors. They are entirely enclosed but the cover is readily removed. An ample number of points provides for smooth acceleration or close speed adjustment.

GEA-823A, "Automatic Hydrogen Arc Welding Equipment" is used for hand welding on 50 and 60 cycle units only. By this means homogeneous, ductile welds may be made on thin metals.

GEA-881, "Gas Engine Driven Arc Welder" was designed to give a source for a welding current that is independent of local power limitations and that will furnish it at all times and in all places. A complete equipment consists of a self excited arc welding generator with control, driven by a suitable gas engine.

GEA-865, "Multispeed Induction Motors" supersedes 61814. These are squirrel cage or wound rotor in two, three or four speeds, 60 cycle, 3 phase, 220 or 440 volts, constant horsepower, constant torque or fan duty.

GEA-874, "Type WD-200 Arc Welder," supersedes 255. This welder is belt, motor or gas engine drive, stationary or portable, self excited, constant energy and single operated. The strength and reliability built into its component parts are of special importance.

GEA-887, "CR3110 Drum Controllers" are manufactured for series and compound wound motors, used on crane hoists and for similar applications.

GEA-949, "CR 2904 Temperature Overland Relay Panels" were designed for use with CR 1034-J2-H2 and H-3 hard compensators. These are especially intended to replace the old style dashpot relay or fuse panels which were finished with CR 1034 hand compensators.

GEA-980, "Enclosed Speed Regulating Rheostats" supersedes 68356. These are designed for starting field control for direct current motors. All moving contacts are readily renewable and the stationary segments are renewable from the front of the base, except in the smaller sizes.

New Hand Control Switch

For application where it is desirable to control a magnetic switch at the switch itself, the General Electric Company has designed two small control switches. These may be mounted in the knockouts of the enclosing case of any starter and are held rigidly in place by a conduit bushing which forms part of the switch.

One type, bearing the designation SY-103-A, is a maintaining-contact type whose action is similar to a single-pole, double-throw switch. It is provided with three positions, hand, off and automatic. The most general application of this switch is expected to be in connection with refrigerating machines controlled by thermostats, but it can also be used where float switches, pressure governors, etc., are used in the same manner as a thermostat in various applications. When the operating lever of this switch is in the automatic position, the thermotat, float switch or governor controls the machine. On the hand position the machine runs continuously, and in the off position the control circuit is opened.

The second type of switch bears the designation SY-104-A and is a two-position, momentary-contact switch provided with the position start and stop. This is the equivalent of the usual push-button station of the same marking. It is most applicable where starting and stopping of the motor is necessary at the magnetic switch itself.

Milburn Paint Spray Gun Has Two Important Additions

The Alexander Milburn Company of Baltimore has made important additions to its spray which include a dialed head. This gives different spray adjustments from a circular spray to a fan of wider field than has heretofore been possible with spray guns. The dialing permits the operator to obtain any desired spray instantly without first making tests.

It has added a series of indicator numerals on the paint valve plunger. A pointer is operated as the operator turns the adjustment button. Just as the dial in the head produces the exact spray wanted, so the indicator numerals on the paint valve plunger provide the exact volume desired without the necessity of losing time by testing. The operator, having found that a certain class of work is best performed when the indicator points to a certain figure, makes the proper adjustment before beginning to spray. The new improvements calibrate all operations and enable the operation to get the proper adjustments for perfect operation. The new Milburn spray gun is known as the Type EF. To enable owners of the Milburn Type E gun to obtain the benefit of the improvements, the new dialed air control valve and the plunger have been made interchangeable and the Type E can may be brought up to date by the insertion of these parts at the factory.

Botfield Appoints Agent

The Builders and Industrial Supply Company of Toledo has been appointed distributor by the Botfield Refractories Company of Philadelphia. The new agents will handle Adamant fire brick cement, Adachrome and the Adament gun in the vicinity of Toledo, Ohio.

Penna Compressor Data

The Pennsylvania Pump and Compressor Company of Easton, Penna., is distributing illustrated bulletin 140 which describes a single stage, double acting, multiple belt driven semi-portable compressor unit, arranged for start and stop control. Total length of compressor is 6 feet 6 inches, weight 1380 pounds with a piston displacement of 65 cubic feet of air per minute. It is driven by a 10 h.p., 60 cycle, 3 phase, 220 volt squirrel cage, high torque motor, running at 1150 r.p.m. and drives the compressor at 400 r.p.m.

The Company has recently perfected and started production of the Pennsylvania improved air cushion valve which is one of the features embodied in the Pennsylvania air compressor. The basic principles of this improved valve are similar to those with which the compressors have been equipped, except that the guard and seat are held together with a retaining ring instead of screws. This has permitted larger part areas and made possible the construction of a valve that is interchangeable in both the inlet and discharge assemblies.

An important feature of the valve is the air cushion pocket in the guard. As the valve opens, the discs enter the pocket and the air so trapped provides a cushion which prevents the valve from striking the metal of the guard. In the design of this valve precautions were taken to provide the greatest factor of safety as there are no bolts, screws or nuts used in the construction.

A Rock Breaker and Granulator

The objective of the inventor of the Economy rock breaker and granulator was to combine many of the size reduction principles into the design of a standardized machine built in various sizes to meet the special requirements of the pit and quarry industries. The machine was to be so designed and constructed that it would decrease costly and frequent replacement of parts and reduce the cost of operation.

The development of this breaker was started in 1908, and simultaneous with the years, changes were made to reconcile a positive and equalizing input feed chamber with a fixed rectangular discharge aperture for a continuous and positive breaking system.

For several years, the positive and rapid breaking principles of the machine were proved in field service, extending into the plants of several states. No basic changes in the design were found necessary and late in 1927, the Economy Equipment Company was formed to enter the field with a machine which had been both tried and proved and had the endorsement of a number of qualified engineers.

The salient features as outlined in the 6 page illustrated "Advance bulletin" being distributed by the company, are low installation cost, light weight, low power requirements and low upkeep costs. It has been found adaptable to the size reduction of all classes of material and will dependably reduce input sizes to minus one half inch of cubiform material by sufficient stage reduction, which may require a one, two or three unit operation.

It is stated that the capacity is positive and large per unit of power because it takes every possible advantage of the friability, cleavage, fracturing and old fractures of the material reduced. The drive shaft bearings are of standard design and protected from grit and dust. Provision for positive lubrication is provided and the speed is from 200 to 400 r.p.m. for primary breaking and from 500 to 800 r.p.m. for granulating.

The machine is presented to the industries with the belief, on the part of the manufacturer, that it will augment the plant output and performance. It is further claimed that it will meet the need for greater adaptability, efficiency and economy.

Upson Joins Chain Belt

Charles H. Upson, who for the past twenty-three years was district manager for the Dodge Manufacturing Company, has joined the sales organization of the Chain Belt Company, with headquarters at Cincinnati. He will represent the company's complete line of Rex Chain and Transmission Machinery. Mr. Upson, who is well known throughout the industrial and mill supply field, will devote practically all of his time to the interests and advancement of the Rex chain.

Byers Gasoline Shovels

The Byers Machine Company has recently issued two new catalogs, one on the Byers Master 1¼ cubic yard gasoline shovel, the other on the Byers Revolving Bear Cat, a ⅝ cubic yard, full revolving gasoline shovel. Both of these catalogs contain complete descriptions of the mechanical workings and specifications.

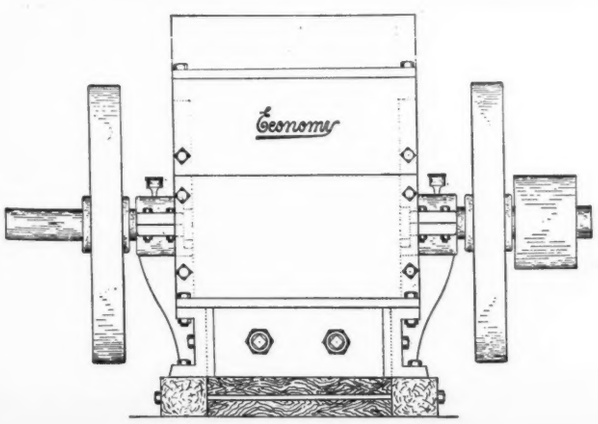
Jones Herringbone Gears

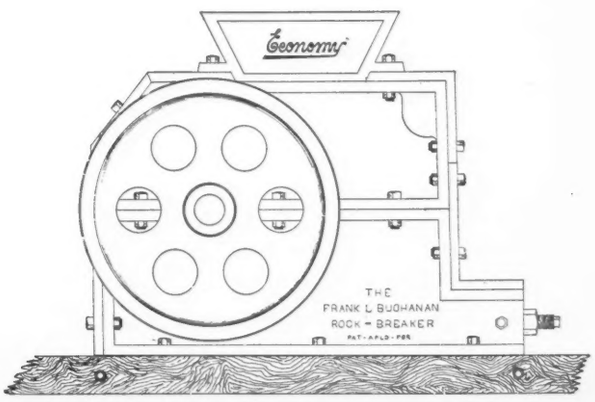
The W. A. Jones Foundry and Machine Company, 4401-51 Roosevelt Road, Chicago, Illinois, is distributing its catalog No. 36 describing the cut herringbone gears of its manufacture. Lists giving the dimensions of various sizes manufactured and horse power tables are included.

Hydraulic Stripping

The Universal Nozzle Company of Indianapolis is distributing an interesting and helpful treatise on hydraulic stripping. It gives a short history of stripping methods and compares present with former methods. The nozzle manufactured by the Universal is fully described and considerable useful data for the use of stripping operators is included.

1,656,004. Crusher. William E. Leine, Stamford, Conn., assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis.





Rates for display advertisements in the Broadcast Section are given below. If you want to buy or sell used equipment, if you want a job or need a man, advertise your wants in Pit and Quarry. Advertisement copy for publication in the next issue should reach our office within one week after the date of this issue.

RATES PER INSERTION	1 Inch	2 Inches	3 Inches	4 Inches	5 Inches	6 Inches	8 Inches	9 Inches	10 Inches	12 Inches	15 Inches	20 Inches	30 Inches
1 Insertion	$3.75	$7.25	$10.75	$14.25	$17.75	$21.25	$28.25	$31.75	$35.25	$42.25	$56.25	$70.25	$105.00
2 Insertions	3.75	7.25	10.70	14.20	17.65	21.15	28.15	31.65	35.15	42.15	56.15	70.00	104.00
3 Insertions	3.75	7.20	10.65	14.15	17.55	21.05	28.05	31.55	35.10	42.05	56.05	69.75	103.00
4 Insertions	3.70	7.15	10.60	14.10	17.45	20.95	27.95	31.45	35.00	41.95	55.90	68.75	102.00
8 Insertions	3.65	7.05	10.50	14.00	17.25	20.75	27.75	31.25	34.80	41.75	55.70	67.50	98.00
13 Insertions	3.60	6.95	10.40	13.90	17.05	20.55	27.55	31.05	34.60	41.55	55.55	66.25	94.00
26 Insertions	3.50	6.75	10.20	13.70	16.65	20.05	27.05	30.65	34.20	41.05	55.05	64.00	88.00

INFORMATION—*"Broadcast"* space is sold by the advertising "inch." Each page contains 30 inches. The width of the page is divided into 3 columns, each 2¼ inches wide. Each column contains 10 inches measured the length of the column. Any space may be used measured by the *even* inch in height (not fractions), by 1, 2 or 3 columns in width. The size of a space is its height in inches multiplied by the number of columns in width. Example: a space 3 inches high by 2 columns wide is 6 inches. Copy changes made without additional charge.

It Pays to Advertise in PIT and QUARRY

"We always get results from the advertising we place with you and can assure you that whenever we have anything to offer, we will ask you to tell the story."—Byron W. Greene, Jr., Co., New York, N. Y.

Complete Service Publishing Company

538 South Clark Street **CHICAGO**

Machinery for Sale

SPECIALS

1—4½'x16" Hardinge Steel Lined Mill

1—No. 6 Williams Universal Hammer Mill

CRUSHERS

Crushing Rolls

1—8"x5", 2—14"x20", 4—24"x12", 1—26"x15", 1—30"x10", 1—30"x16", 2—36"x16", 2—42"x16", 1—54"x24".

Gyratory

All sizes from No. 2 Reduction to No. 12K.

Jaw

One 4"x8"—two 7"x10"—one 6"x20"—two 9"x15"—one 10"x20"—two 12"x24"—one 18"x36"—one 24"x36"—one 42"x30".

Rotary

Two No. 0, two No. 1, one No. 1½, and one No. 2 Sturtevant Rotary Fine Crushers.

Ring Roll

One No. 1 and one No. 2 Duplex Sturtevant ring roll mills.

Ball and Tube Mills

3', 4', 4½', 5', 5½', 6', 8' Hardinge Mills and Tube Mills.

DRYERS

One 3'x30', Three 4'x30', One 4½'x30', One 5'x40', One 5½'x40', One 6'x60', One 7'x60' and One 8'x80' Direct Heat Rotary Dryers, One 5'x25', one 6'x30', Two 8'x80' Ruggles Coles type "A" and One 4'x20' Ruggles Coles type "B" Double Shell Rotary Dryers.

KILNS

4'x40', 5'x60', 6'x60', 6'x70, 6'x90', 6'x100', 6'x120', 7'x80', 8'x125'.

MILLS

Two 33" and two 42" Fuller Lehigh Mills.

1 No. 0000, 1 No. 00, 2 No. 1, 2—4 Roll, and 1—5 Roll Raymond.

Swing Hammer Mills, Griffin Mills, Attrition and Cage Mills.

Air separators, Screens, Elevators and Conveyors.

The Heineken Engineering Corp.

Industrial Engineers

117 Liberty St., New York City

Courtlandt 5130

LOCOMOTIVE CRANES

1—15-ton Brown Hoist 8-wheel, M. C. B. 46-ft. Boom, 1½-yd. bucket, A.S.M.E. Boiler, strictly first class condition. Price $3500.00 F.O.B. Detroit.

1—15-ton Browning 8-wheel, M.C.B. 40-ft. Boom, 1½-yd. Bucket, A.S.M.E. Boiler, rebuilt, in first class condition. Price $3500.00 F.O.B. Detroit.

LOCOMOTIVES

1—25-ton 12x16 Porter Saddle Tank, standard gauge, A.S.M.E. Boiler, working pressure 160 lbs. Price $3500.00 F. O. B. Detroit.

1—20-ton Montreal Locomotive Works Saddle Tank, standard gauge. Price $2,000.00 F. O.B. Cars Windsor, Ontario.

STEAM SHOVELS

1—Marion Combination Steam Shovel & Crane, capacity ¾ yd., Caterpillar Traction. Price $4,000.00 F.O.B. Detroit.

1—Bucyrus 50-B Combination Steam Shovel and Dragline, Caterpillar-Traction, capacity 1½ yd.

Michigan Equipment Co.

2847 Grand River Ave., Detroit, Mich.

Phone: Glendale 6927

CENTRIFUGAL PUMPS

10—Allis-Chalmers 10-in. suction and discharge Direct connected to 200 H.P. 3 phase, 60 cycle, 2200 Volt Motor, capacity 3500 G.P.M. at 180 ft. head.
12-inch Morris Steam Drive.

DREDGE PUMPS

2—Morris 8-inch Steam Drive.

DRAGLINES

Class 24 Bucyrus Electric.
Class 14 Bucyrus Steam.

DUMP CARS

8—K. & J. 4 yd. 36-inch gauge.
4—Western 6 yd. standard gauge.
10—Koppel 1½ yd. 24 inch gauge.

GASOLINE LOCOMOTIVES

2—Plymouth 4 ton 24 inch gauge.

STONE SCREEN

Heavy Duty 3 ft. by 12 ft. Roller Type A.C. Motor Drive.

THE U. G. I. CONTRACTING COMPANY

Attention: Mr. R. C. Stanhope, Jr.
Supervisor of Equipment,
U. G. I. Building Philadelphia, Penna.

CRAWLER SHOVELS

2—ERIE B-2 DREADNAUGHT, Steam Caterpillar, New 1926, 1-Yd. Dippers, HIGH LIFT; Overhauled, Like New.

1—50-B BUCYRUS, Steam Caterpillar; New 1927; 1¾-Yd. Dipper; Used few months; Perfect Condition.

1—OSGOOD HEAVY DUTY (1-Yd.) GASOLINE Caterpillar, 1-Yd. Dipper, HIGH LIFT, Excellent condition.

CRANES

1—NORTHWEST, Model No. 105, Gasoline Caterpillar Crane, New 1926, 40 ft. Boom, Bucket operating, Overhauled, Excellent condition.

2—25-ton, 8-wheel, INDUSTRIAL, Type G, Locomotive Crane, New 1927, 50 ft. booms.

DUMP CARS

25—5-yard, 36 in. gauge WESTERN, two-way side Dump, new 1927; STEEL DRAFT BEAMS; used few months, perfect condition.

GREY STEEL PRODUCTS CO.

111 Broadway New York, N. Y.

FOR SALE OR RENT

DUMP CARS

5—12-yd. Western, Std. Ga., Air. Perfect Condition.

GASOLINE SHOVELS AND CRANES

1—Link-Belt Comb. Gas-Crawler, 1-yd. Shovel and 15-ton, 50 foot boom Crane. Like new.
1—Northwest, Model 105, 50' Boom. 2-yrs-old.

STEAM SHOVELS

1—McMyler ¾-yd. Cat. Steam; also 40' Crane Boom. New 1927.
1—Marion, Model 32, 1¼-yd. Dipper, Full Cat., High Lift, Rebuilt 1927. Perfect shape.

GASOLINE LOCOMOTIVES

2—7-ton Plymouth, 36" Gauge. Like new.
1—8-ton Plymouth, 36" Gauge. Like new.

HOISTING ENGINES

1—40 HP. Mundy, DD, 2-ph., 60-cyc., 220-v.
1—22 HP. Lambert, DD, 2-ph., 60-cyc. 220-v.
1—7x10 Lidgerwood, DC, DD, Boiler mounted with Swinger attached

BOILERS

1—125 HP. Locomotive Type, ASME, 125 lb. Pressure.

TRACTORS

1—10-ton Holt, Gas. Cat.
1—2-ton Holt, Gas. Cat.
1—5-ton Holt, Gas. Cat.

B. M. WEISS

1324 Widener Bldg., Philadelphia, Pa.